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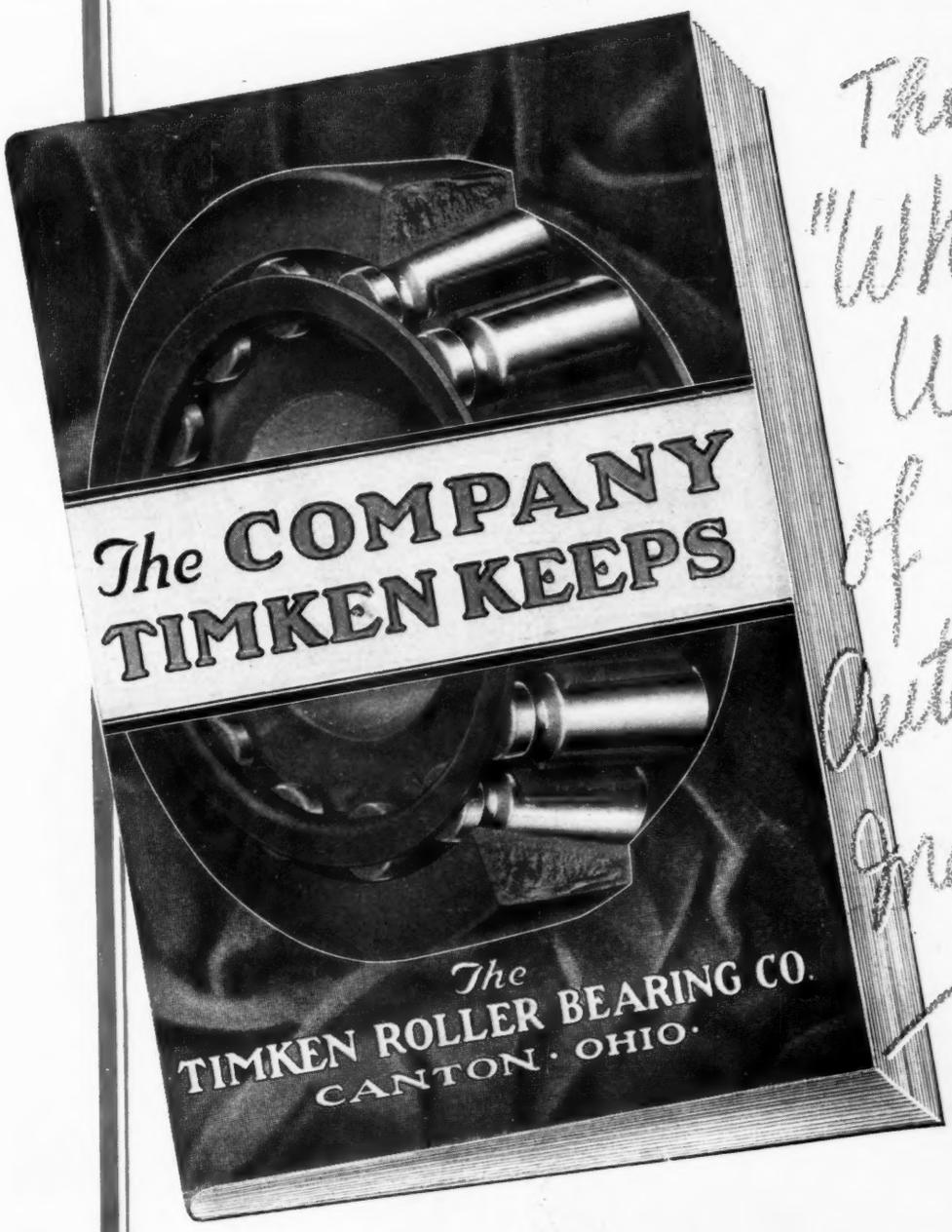

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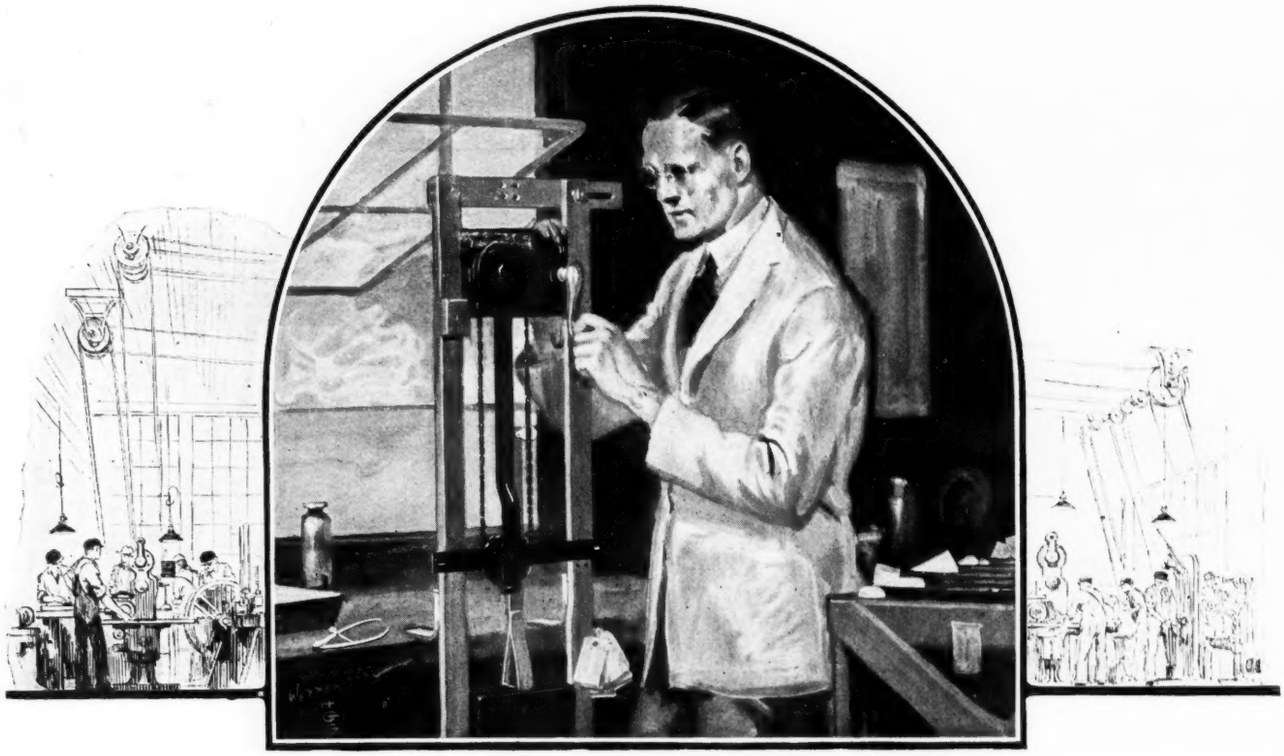

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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XLVI. NEW YORK—THURSDAY, JUNE 1, 1922. No. 22

Better Cars at Lower Price—A Production Achievement

Marketing and production closely allied. Unbalanced inventories unlikely in future. Machine tool development important. Careful shop planning major factor in ability to join quality with quantity production.

By J. Edward Schipper

AUTOMOBILE prices are about on the same level as before the war, but the car of to-day is far better than the pre-war vehicle. We are getting better automobiles for less money. At the same time labor employed in the automobile industry is making more money, and the car owner is getting a better return for his investment.

The tremendous strides which have been made in production methods are chiefly responsible for this remarkable accomplishment. The improvements go from one end of the line to the other. The raw materials are better, methods of fabricating are better, inspections are closer, assembly is more carefully conducted, and yet, with all of this added value in the product, the manufacturing departments are turning over the cars to the sales departments for about the same money as in the pre-war period.

Young as the automobile industry is, it has already passed through well-defined phases. It is quite possible now to look back and see that during the years of 1900 to 1912 we were in the design and engineering phase. New things were tried out and research and development work played an important part.

Starting at somewhere around 1909 and up to 1916, we had a development phase in the shop. During this time the increased use of alloy steels and better manufacturing methods for handling them were developed, both in a small way and as a big production proposition. Then came the wonderful experience in which our automobile and parts factories participated of manufacturing war munitions on a huge scale. This involved the combination of engineering and manufacturing in a way which the industry never before attempted.

The lessons learned from 1915 through 1918 are now being incorporated into the industry. The insistence of our own and the foreign governments on the highest class of workmanship on a product which had to be produced in tremendous quantities and whose life when brought to the war front was possibly measured in an average period of only minutes, opened the eyes of our manufacturing men to a new standard in production.

At the outset, men who had been in commercial manufacturing lines all their lives threw up their hands at the specifications of the government, which required working to fractions of a thousandths of an inch in quantity production. Within a few months the limits imposed by the Government ceased to present any problems. New machining methods, new single purpose machines and new types of jigs and fixtures solved the problem.

Since the war we have entered into another period. We have been educated to quality in a way which would never have been possible without the war. Due to the stringent times after the war a burden of cost cutting was thrown on every department in the factory. The engineering department was forced to arrange its designs to accommodate the tool equipment of the factory so as to secure proper performance and keep production costs at a minimum.

Never again will the automobile factories be caught with the tremendous inventories which resulted in the sudden coming of the deflation period which started in the fall of 1920. When it is considered that March, 1920, was the biggest month in the history of the automobile business, and that December of the same year was one of the worst, some idea of the quick changes which can occur, due to a radical change in fundamental conditions, is gained. This furnished another lesson which is having its effect to-day on methods.

With this short sketch of the background behind present manufacturing improvements, we can discuss the possibilities of further progress towards still greater improvements in design and manufacture so as to take an even greater step in turning out a better vehicle for less money.

Not so long ago a design was judged by its performance. To-day a design is not good unless it has, outside of its performance, the qualifications which make it possible to produce the product at a low cost. It is customary and proper, therefore, that in these days before an automobile is put into production, after the engineering department has fully gone through its tests and become satisfied with the performance standpoint, the design should be turned over to the manufacturing expert to see that it is adaptable to high speed production methods and tools. The engineer is primarily interested in seeing that the car has good acceleration, economy, lightness, good power output for the engine size, that it performs quietly, has long life, accessibility and that the layout is so arranged that the wear is taken by parts which are easy to replace, so that the car can be kept young.

Critical Study of New Design

When the production manager gets hold of this same design he goes over it to see that the rough cuts can be slabbed out, that the parts to be milled are as near as possible all in the same plane on all four sides of the engine. He scans it critically to see that the number of operations on the new job are just as few as they can consistently be. He looks to see if it is adaptable for multiple drilling, if suitable sub-assemblies can be arranged and if the assembly work is simple, so that not too much time is consumed in putting it together. He is also anxious to use regular shop tools on assemblies and not special tools to any great extent. When a design is satisfactory from the standpoint of both the engineer and the production man, it is finally passed upon and turned over to the shop to build.

Before taking up the methods in the shop, let it be clearly pointed out that the history of the automobile business has shown that only those who are honest in their production methods have survived. In spite of a mushroom growth when big profits were made during the first few months, concerns who have not had an honest manufacturing policy have invariably failed.

In choosing his equipment, the manufacturer must bear in mind the number of machines he intends to turn out per day. He must consider whether his output is sufficiently large to put in a progressive conveyor system. He must consider also whether he should use single purpose machines which are of a stock character. As one manufacturing executive expresses it, "single purpose machines will effect wonderful economies and a few idle machine hours per day cannot be compared to the expense of numerous set-ups on some particular machine and the possibility of a large percentage of defective parts made by new set-ups. This, of course, does not refer to manufacturing done on a tremendous scale."

Choosing Machinery

The judgment required in selecting and purchasing the machinery for manufacture cannot be over-estimated, as it is this judgment which will, more than anything else, determine the success or failure of the enterprise. Tremendous strides in machine tool design have been made since armistice day. The automobile industry is responsible for not a few of these big developments, and the war has been responsible for a number of others. At the same time, the manufacturer should not let his enthusiasm over new machinery run away with his judgment to the extent that he will put his machinery either out of balance with the merchandising capacity of the plant, or that the plant itself will be out of balance, so that certain machines will run so far ahead of others in the production scheme that the machines will be standing idle for a considerable length of time.

A company has always just so much working capital to utilize. Some of this is going into machinery, some of it is going into material in process and the rest is going to carry the overhead and sales expense. A careful survey of the amount of cash available must be made before any logical manufacturing program can be laid down. It is then necessary to balance all of the factors.

It will be interesting to quote the words of the factory manager of a concern which has just recently gone into the automobile manufacturing business and is now turning out 25 per day, making its own engine and a large number of other units, and which will shortly be manufacturing about 50 per day and will gradually manufacture its entire car.

In discussing this matter, this production manager said, "Having perfected a satisfactory design of vehicle, the next step is in the selection of suitable manufacturing equipment, and it is here that many errors are made. The greatest care must be exercised in planning the manufacturing operation and equipment arrangement.

"Much has been said and done in the past in regard to feeds and speeds of tools and the steels used in cutting tools. The automotive industry owes a great debt to that great genius, Frederick K. Taylor, the inventor of high speed steel. It was he who forced a complete redesign of all metal-cutting tools that they might withstand the speed and strains that are imposed on them to-day. I do not look for any radical or great improvements to be made in our machining methods of to-day, and one would have to cut corners very closely in any well-organized plant to effect any great savings in the cost of a vehicle by altering the processes.

Small Production Savings

"I recall an experience I had recently where I was called in to make a cost analysis on a vehicle marketing at about $5,000. After going over the operations of every part and assembly very carefully, I could only guarantee a saving slightly over $14 on direct labor per vehicle, and this would have required quite an outlay of new machinery and jigs. The difficulty in this particular plant was the tremendous manufacturing, administrative and investment burdens.

"There are two very important factors which are worthy of careful consideration, and when properly dealt

with, will have a great bearing on the cost reduction of automotive manufacturing. The most important of these is the laying out of a conservative manufacturing program, intelligently based on the sales requirements. Then a careful survey must be made of the manufacturing equipment to definitely insure that the manufacturing departments can perform in accordance with this program on an economical manufacturing basis.

The Planning Department or Materials Division must plan a concrete program indicating the minimum amount of material required in process between the shipping docks and the receiving room in order to maintain the schedule. This particular division must operate intelligently and on a scientific basis, using such information as is provided them by the plant engineering department, in the way of machine loading and the man hours required in the various assembly departments, so as to direct a uniform flow of material through the plant. The gathering of this information must be based upon actual facts, and guess work must be eliminated. If such a procedure is carefully followed, and the purchasing division brings the material in in accordance with the requirements as laid down by the material division, it is possible to operate with a comparatively small inventory, which lessens the investment burden, eliminates a great amount of non-productive labor, and enables the manufacturing departments to operate on material in suitable-sized lots so that the manufacturing can be done economically.

"The mistake of carrying tremendous unbalanced inventories is often made, production being limited by the smallest amount of material on hand. The unbalanced portions throw a very heavy burden upon the manufacturing departments in many ways. I do not believe in resorting to a lot of red tape in the material or planning division, but in using a few sound and essential principles devised by a few intelligent and energetic men, and after having devised a satisfactory plan, then see that the plan is made to work.

"I believe a greater saving can be effected by intelligent planning in the materials division and by the elimination of unnecessary non-productive work which creeps into every manufacturing institution and which is due principally to unintelligent planning, than can be effected by the employment of a large crew of feed, speed and process experts. Efficiency in manufacturing must start from the top down and not from the floor sweeper up.

"We will now assume that the engineering program is satisfactory, that the plant engineering has been conducted intelligently, and that the manufacturing processes are suitable and efficient in proportion to the quantity of vehicles to be manufactured and that the sales program has been dealt with intelligently, and the materials division has laid out a suitable and efficient manufacturing program and has forwarded the necessary information to the purchasing department so that they can have ample time to shop around and purchase economically, and insure that the material will be brought into the plant in accordance with the requirements as laid down by the material division.

"The next important step is the selection and training of proper executives for the various departments. We have neglected to develop production executives along the proper lines. In the past few years the tendency has been to specialize men along certain lines of work, and the all-around mechanical executive is a rare specimen. I believe that it behooves every manufacturer of automotive equipment to put a great deal of effort in the proper training of manufacturing executives because it is upon them that the success of the manufacturing program is finally dependent.

"Quality cannot be introduced into an article unless the manufacturing executives are thoroughly trained, all-around mechanics with broad executive ability. Inspection cannot detect and correct all the errors that are introduced into an article due to the lack of knowledge of foremen or the men directly in charge of manufacturing. Quality in every article must go all the way through. Every operator must be properly instructed and patiently dealt with until he finally understands how to perform his work in a high-grade and efficient manner. When an organization of men are so trained, great savings will be effected all along the line. There will be less defective material made in the machine shop, less expense involved in the inspection of good material, and less hand-work necessary in the assembly, and also less time required in the running-in process of units that are built from correct material, and running-in processes never correct defective workmanship.

"In fact, there is no substitute for quality, and I believe any manufacturing institution which is run along the lines I have outlined above will show a lesser monthly or yearly productive cost than if that institution is operating under haphazard methods with resultant defective or questionable workmanship.

"The productive cost of any article cannot be measured wholly by the cost required to place that article in the shipping department, but should also be measured by the amount of service and the expenditure required to advertise and keep the article sold, and in the end the institution which does not manufacture an article worth every dollar of the selling price cannot be successful financially or otherwise."

This is a very accurate summary of what confronts the factory executive when he determines upon a production schedule, and when he sets about lining up his factory to produce according to that schedule, and also to line up his merchandising department so that his selling plans coordinate themselves to his production, not only in regard to the number of distributors he takes on, but as to their geographic situation so that he will be strategically located in his sales strength in such a way as to make expansion possible with the least degree of trouble.

(*Continued on page* 1157)

THE motor car is the only complicated mechanical device that has ever been marketed in quantity for the use of unskilled operators. Its production involves problems of design and manufacture unique in industrial history. There are more machine tool operations on a four-cylinder passenger car motor than on a steam locomotive.

Production of this kind involves numerous difficulties. Constant study has been essential to progress. Further developments are in store.

Present car prices are about equal to pre-war prices. But the vehicle is far superior to the pre-war product. That is an achievement of which the industry may be proud.

This article tells something of how these results have been achieved, but is chiefly concerned with an analysis of what we may expect in the future as a result of production studies now under way. Mr. Schipper has studied the field carefully and treats the subject from a broad administrative angle.

Railcars Are Needed—But What Type?

Close co-operation between automotive and railway engineers is necessary to produce right type of car. Railway men are not yet sure what size or type of vehicle will best suit their needs. Quantity production unlikely in the near future. Large six-cylinder engines a probable development.

By Herbert Chase

THE railways need railcar equipment but are themselves uncertain as to the size and type which will best meet their needs under various conditions of service. Dependability is a factor of first importance and some installations of railcars have already shown greater freedom from trouble than steam equipment. Nevertheless much development work will be required before the railcar is satisfactory from all standpoints. The railways are disposed to co-operate and are removing some obstacles which have hitherto precluded rapid or wholly satisfactory development. They are looking to the automotive industry for aid in solving some of their problems which steam equipment has failed to meet.

These and many other factors of importance to the automotive industry were brought out at a meeting of the Metropolitan Section of the Society of Automotive Engineers held in New York on May 25. The speakers were chiefly railway men practically all of whom appeared to be convinced of the possibilities of successful railcar construction and operation once the right type of equipment has been found. It was made clear that the wide variation in conditions met in service will make it difficult to standardize either on type or size of equipment needed so that quantity production probably lies some distance in the future. On the other hand, it was shown that many installations have already established enviable records which have never been equalled by steam-driven equipment. It was made clear, however, that present railcars leave much to be desired in certain directions, especially in the matter of comfort to the passengers. Experienced railway men are inclined to the belief that the light railcar can never be made so comfortable as the heavy railcoach, but there are certain compensating advantages especially in the matter of lower operating costs and the consequent possibility of giving more frequent service which tend to offset the drawbacks.

Railway Men Skeptical

R. H. Wright, editor of *Railway Age*, called attention to the fact that there have heretofore been several cycles of development in the railcar field which started with considerable enthusiasm and good prospects but usually ended in unsatisfactory service due in large part to lack of reliability and high operating costs. For this reason railway men are apt to be skeptical about present developments, although they realize that there are possibilities of material reductions in expense as compared to steam equipment which can seldom be operated profitably on short branch lines when the traffic is light. It is coming to be realized, however, that the rapid development of the motor truck and the greater experience in relation to factors which make for dependability and lower operating and maintenance costs tend to overcome certain disadvantages heretofore encountered.

Motor truck manufacturers are inclined to favor lightweight construction, Wright said. Such construction is necessary because of the relatively small power which is developed by existing types of truck engines. For production reasons they are also inclined to favor the use of standard parts which may not in all cases be suitable for rail service. It is his belief that it will be necessary to develop special engines of larger size and greater flexibility. There is some doubt as to whether the conventional mechanical type of transmission will be suitable. Hydraulic and electric transmissions must be considered as possible substitutes.

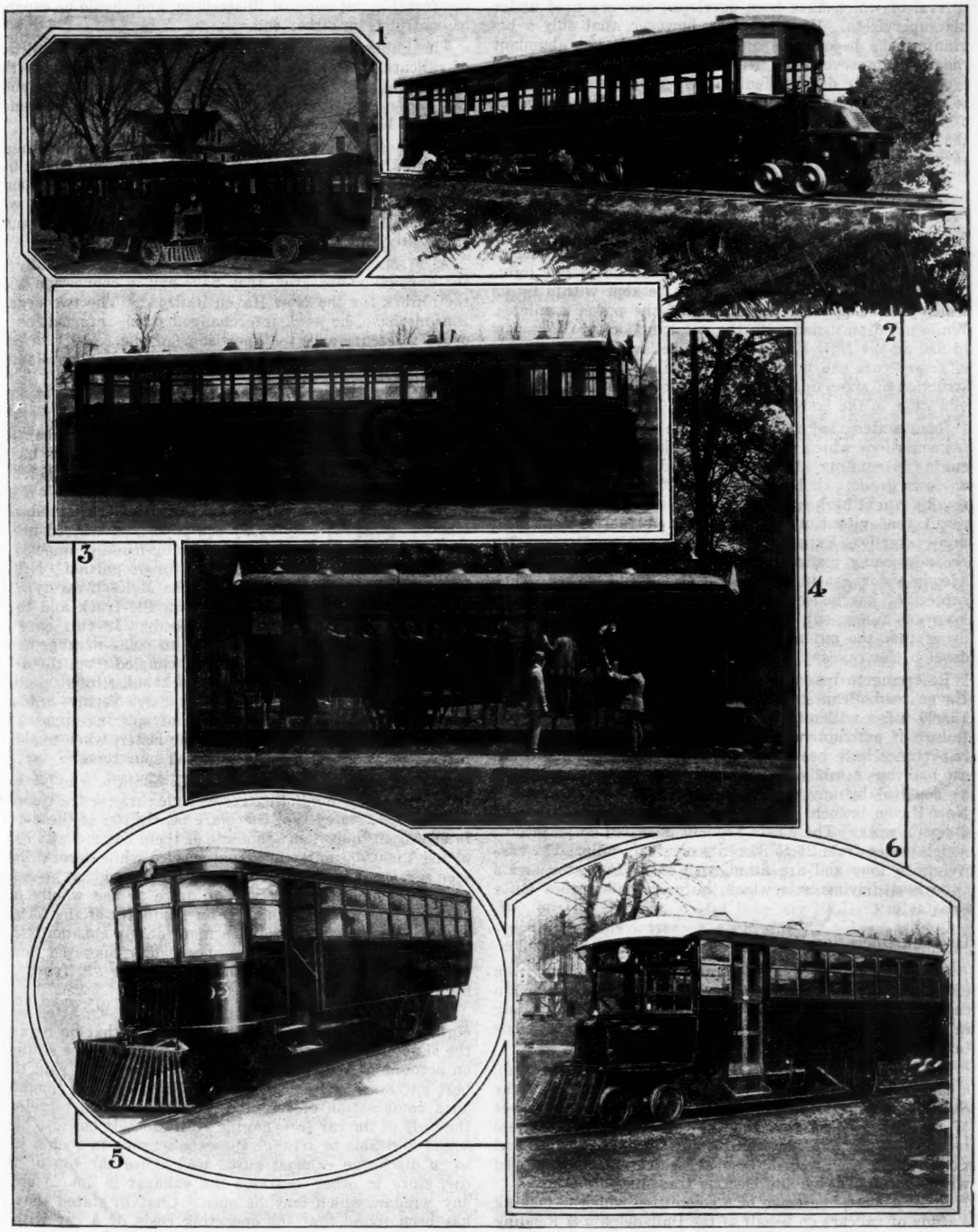
Wind Resistance Must Be Considered

The question of wind resistance must also be given careful consideration, as this is one of the important factors affecting speed. Safety considerations and government requirements in this connection are now controlling factors in certain directions. It is probable that in some cases a car which can be controlled from either end will be required and it will be necessary to sell the public upon the advantages of the railcar before they can be utilized extensively.

L. G. Plant, associate editor of the *Railway Review*, submitted a paper which was read in his absence. This drew attention to the fact that high maintenance costs had resulted in many failures in connection with the earlier applications of railcars. Plant is of the opinion that the present type of light car using alloy steels is a big advance due in part to the development of more flexible and higher speed engines. He drew attention to the development of light cars for electric railway service some of which weigh only 11,000 lb. complete but are capable of seating forty-two people. Cars of this type he believes present possibilities for railway use when fitted with suitable internal-combustion engines. He is of the opinion that cars with a capacity as high as eighty passengers can compete successfully with steam trains having the same passenger capacity.

Plant indicated that some competition may be expected from equipment of the unit steam car type, especially in view of the fact that such cars are readily equipped with an engine of 300 hp. as compared with a maximum of about 60 hp. now available from truck engines. It is his opinion that the possibility of using cars with two truck-type engines should be investigated, since they can probably make possible greater reliability and economy, although they present certain problems in transmission design which are not to be easy of solution. The problem of preventing excessive vibration must be given careful consideration as must also the type of railway truck employed. The present type of truck used in railway work has certain practical advantages which should not be overlooked in the development of railcars.

W. L. Bean, mechanical assistant to the president of the



Examples of railcars produced by various American manufacturers. 1—F. W. D. used in street railway service. All four wheels are drivers. 2—Edwards railcar and trailer. All four wheels of rear truck on leading car are driven by chain from a jackshaft. 3—Service railcar. All four wheels of leading truck are positively driven by bevel gears. 4—White. 5—Duplex. 6—Service railcars are based largely on truck chassis of the same make and have two driving wheels with live axles, and a four-wheel leading truck of more or less conventional railway type

New York, New Haven & Hartford Railroad, frankly admitted that he is an enthusiastic believer in the railcar, several of which have been developed and are used under his supervision. He recognizes, however, that only a beginning has been made and that there is yet abundant room for improvement. He expressed the belief that the cycle of railcar development now in progress is more apt to succeed than earlier efforts along similar lines, because of the greater experience gained in recent years through the development of the motor truck. But it will be necessary, he said, to get away from highway vehicle construction in some cases. The relatively short and light railcars now employed are admittedly not so comfortable as the heavier railway coaches, which, because of their great weight, deflect the roadbed and are therefore less subject to the effect of irregularities than is lighter equipment. For this reason railcars should not be made too light, though of course their weight must be kept within limits which can be handled by engines of the power available. While not dissatisfied with the present Mack railcars now in use on the New Haven road, he believes that more satisfactory cars can be developed possibly through the construction of six-cylindered engines which will transmit less vibration to the body of the car.

Bean stated that it would also be desirable to develop transmissions which are more suitable especially when the engine is running at light loads with the car "drifting" on down grade. Under present conditions the engine must usually run at high speed when the car is coasting, with the result that vibration is excessive and fuel is consumed unnecessarily. Experiments with variations in gearing are now being made. Radiating surfaces must be made adequate for continuous operation at full power. The subject of car heating also requires study, and steps to keep gas fumes out of the body must be taken. He believes that the automotive industry is the logical one to develop the railcar in co-operation with the railroads.

Referring to railcar equipment now in use on the New Haven road, Bean stated that one such car had been run 15,000 miles without losing a single trip because of any failure of automotive features in the car. No repairs of importance have been required during this time, and the car had thus established a record which, he said, could not be equalled by any steam equipment. One railcar on a New Haven branch line makes a 146-mile run every day, 6 days a week. These cars are now operated on an income which varies from 25 to 85 cents per train-mile. The cars weigh 15 tons and are fitted with shock insulator and a two-wheel driving axle which, he said, had proved quite satisfactory.

Two-end Operation Would Save Time

Bean stated that cars equipped for operation from either end would be of considerable advantage in certain cases on the New Haven roads, because of the saving in time which such construction would effect in some terminals.

For the purpose of comparison and discussion C. B. Veal, a consulting engineer who is also one of the officers of the Section, gave a brief description of some existing types of railcars used in this country and in Europe. These included the Edwards, Bowen, White, Indiana, Service and a car built by the Swedish General Electric Co. and equipped with a Diesel engine and electric transmission.

R. B. Abbott, chairman of a committee which is making a study of railcars on behalf of the Philadelphia & Reading Railroad, stated that this committee has not yet reached a decision as to the type most suitable for use on their branch lines, but have about concluded that it will be necessary to use a car capable of handling one or possibly two trailers in order to take care of wide fluctuations in traffic. He stated that the railcar finally selected must be comfortable, not noisy or ill-smelling, and should be capable of control from either end.

The Pennsylvania Railroad is studying the possibilities of railcars, but no such cars are now in operation by the Pennsylvania system, according to Mr. Burrell. One such car, however, operated by another company on a branch line, has been under close scrutiny.

A. J. Scaife stated that the White Co., with which he is connected, has had railcars in operation for nine years, but is still desirous of learning more about the requirements of service. In some cases he believes two small cars will be much superior to one of large size when the latter must frequently run with very light loads.

A. F. Masury of Mack Trucks, Inc., spoke especially of the unusual co-operation they have had in connection with their work for the New Haven Railroad. The two organizations have, he said, interchanged much information in order to secure a better knowledge of the respective conditions to be met by the two organizations in developing the railcars now in use.

Light Railcars Feasible

L. G. Nilson, who several years ago was engaged in the development of the Strang railcar, stated that he is pleased to see the present evidences of willingness to accept lighter cars than were formerly demanded. Heretofore compliance with Master Car Builders' standards, which provide for very heavy equipment, have stood in the way of light construction and thereby made it impossible to use existing automotive engines for propulsion. Nilson suggested a possible reversion to the McKean car type in which the powerplant is mounted on the truck and independent of the frame of the car body. In this case he stated it would be readily possible to make arrangements whereby the body could be easily uncoupled from the driving truck and another driving truck substituted so that little delay would result when extensive repairs are required. He recommended the use of spur as opposed to bevel driving gears, stating that the latter, when made in large sizes, are less durable than the spur type.

In concluding the discussion, H. G. Chatain, who has had long experience in building gas-electric cars for the General Electric Co., stated that there are nearly 100 of these cars in operation to-day, and that one of them has recently completed 1,000,000 miles in actual service while several have seen service of over 600,000 miles. He stated that he much prefers the gas-electric type of drive to the wholly mechanical type owing to the greater flexibility of the former and the fact that it permits a more nearly constant loading of the engine which can be readily operated below normal speed even though the car may be "drifting" at high speed.

Many of the General Electric cars have been fitted with eight-cylinder engines, but Chatain stated that he regards the six-cylinder type or some multiple of six more suitable on account of a less tendency to vibration. He said that best success has been attained with the engine mounted on a combination of felt and springs intended to relieve the body of the car from engine vibration. It has also been found desirable to arrange the exhaust pipe in such a way as to discharge exhaust gases well above the top of the car, since in other locations the exhaust is apt to enter any window which may be open. Chatain stated that it has been found that the operating costs of a car with a mechanical drive is sometimes less per mile than is that of a gas-electric, but that the greater expense in the repair of the mechanical type more than offsets any decrease in operating expense.

European Makers Adopt Quarter Elliptic Springs for Light Cars

This mode of suspension is increasing in popularity on light and medium weight European cars. Modifications in original application have been found necessary in practice. Standard and Wolseley offer good examples of a "safety leaf." Carrow shows use of a radius rod in construction.

By M. W. Bourdon

THE quarter elliptic type of spring, which at one time was considered to be suitable only for cycle cars, has since the war found an increasing measure of popularity on European—but particularly British—cars of all sizes from the cycle car to the eight-cylinder seven-passenger chassis. Its use has presented new problems for solution, not the least important of these arising from the localized stresses imposed upon the side members of the frame due to each unit of the suspension having but one point or area of attachment to the chassis. This factor has been overlooked or ill-considered in a few instances, and frame distortion under load and shock has then been followed by fractures.

No matter what type of spring is used it is preferable that the anchorages on the frame be immediately under the latter, as this avoids torsional stressing of the members, and this desirability is obviously more pronounced when quarter elliptics are adopted. This, however, necessitates a wider frame than usual, unless the spring supports on the axle are located comparatively near the center line of the chassis, which is undeniably bad practice, owing to the resulting overhang of axle ends and wheel bearings. The usual tendency, therefore, is to make use of projecting brackets for the butt ends of rear quarter elliptic springs and to provide a deep cross member of the frame in transverse alignment with the brackets, besides making the side members of deeper section thereabouts.

Citroen Spring Suspension

Variations from the tendencies mentioned are, however, not infrequent, and two of the accompanying sketches (Figs. 1 and 2) show examples of divergences. The first of these depicts the Citroen scheme, which is applied to a frame tapering outward from front to rear. The back springs continue this taper and are therefore not parallel with one another. The top flange of the frame side is extended to form a tongue, which is shaped so as partially to encircle the butt of the spring some 8 in. from its ends; two bolts and clamping plates hold it in position here, the holes in the frame for the top plate being large enough to allow the spring to be securely clamped. Through the extreme end of the butt is a bolt passing also through the frame flanges with a suitable distance washer above the uppermost leaf.

In the A. C. six (Fig. 2) the spring butt is located in the frame channel, but the channel faces outward and the lower flange is cut away in front of the spring pad on the axle and is omitted from the upturned rear horn of the frame side. To overcome the weakness which such an arrangement would entail with a spring having a square butt end, the leaves are continued progressively, as indicated in the sketch, so that the lowest one extends forward 5 in. or so on the bottom flange. U-bolts alone thus suffice to clamp the leaves to the cut-away portion of the channel. The frame in this case again has a continuous taper from front to back, the rear springs similarly departing from the longitudinal center line of the chassis.

Divergent Practice on Standard

In the Standard chassis the frame is of exceptional width at the rear with parallel sides behind the offset of the members in line with the dashboard; the quarter elliptic spring is, therefore, located under the frame members, being secured by a bolt passing through the butt end and the bottom flange of the channel. (Fig. 3.) There is also a pair of clamping plates and bolts, but only one of these—the outer and longer of the two—serves to locate the spring by passing through a small bracket attached to the outside of the frame web. This method of securing the butt end may not be ideal in failing to clamp the whole of the channel to the spring; but it has the merit of providing an unbroken surface on the top of the channel for mounting the body frame. The rear ends of the springs slide on brackets depending from the axle casing, and a torque tube encloses the propeller shaft.

Three out of four Wolseley models now have quarter elliptic springs back and front, but divergence in practice is evident in their mountings. On the 15 hp. the butt ends are attached to frame brackets on the outside; but on the smallest model they are under the channel, secured to the latter on each side by a long bolt adjacent to the front end and passing through both top and bottom flanges of the frame, and by a U-bolt also taking in the top flange. (See Fig. 4.) In this case a single stout blade runs from the top of the channel to a bracket above the axle casing, so that, with the main spring having an anchorage for its rear end under the axle, a parallel motion arrangement is provided to take torque and drive. Also in the G.N.—a very popular light car—a spring blade is used to provide a parallel motion arrangement for the front axle, as shown in Fig. 5.

One or two other makers provide a radius rod. On the Carrow light car (Fig. 6) the spring slides in a "box" attached to the axle, the box having a rearward extension to form a lug for the tubular radius member; the latter is supported at the other end by a bracket depending from the butt end of the spring, the trunnion bearing being of the self-aligning ball type. Another instance of the use of a radius rod is seen in Fig. 7, a parallel motion effect being secured.

There is also a problem involved in the fastening of

the thin ends of quarter elliptic springs, for which various solutions are in evidence. It is not usually considered safe to depend only upon a single master leaf for attachment, for a fracture would lead to a serious smash by the displacement of the axle. But the inter-movement of two full length leaves due to their being flexed prevents both of them being rigidly secured to their point of attachment or support. A "safety leaf" in one form or another is therefore provided as a rule, and Fig. 8 (Standard) affords an example. As will be seen, a short leaf and the extreme end of the master leaf are bolted to a plate resting on the channel axle, the other end of the short member being curved around the bolt of a spring clip of the usual kind attached to the third main leaf; a U-bolt locates and secures the axle plate and the full-length, safety and second leaves on the axle.

This scheme is obviously open to criticism, for the reason that if the U-bolt is sufficiently tightened to hold the front end of the spring firmly to the axle, relative movement between the first and second leaves is prevented. In practice, it would seem, the tip of the second leaf is sure to become loose enough under the U-bolt for inter-movement to occur, and when that happens the whole assembly will have a precarious anchorage on the axle; obviously it would be better if the plate were integral with the axle and the U-bolt clamped down only the first and safety leaves.

Modifications on Wolseley

The 7-hp. Wolseley (Fig. 9) has the modification last mentioned, the spring plate or pad being integral with the axle. In this case, however, the second main leaf does not reach as far forward as the coiled end of the safety leaf, whereas the writer's suggestion is that the point of the former should overlap the latter but not run under the U-bolt. In the 15-hp. Wolseley (Fig. 10) five of the main leaves run forward beyond the coil of the safety unit; the full-length leaf is coiled at the end and located by a transverse bolt passing through the sides of a separate plate, the latter being located on the axle by a U-bolt passing through wings of the plate and through the axle pad; the safety leaf is held in position only by being clamped by the U-bolt. This plan obviates the need for a bolt hole through the end of the master leaf, but this is hardly, it would seem, a feature justifying the additional cost of the scheme.

An arrangement which has nothing to warrant its adoption unless it be the designer's preference for a tubular front axle, is that illustrated in Fig. 11. Here two horns fixed to the axle take the spring pin and a fixed bracket extending rearwardly some 6 in. prevents the axle from rotating by being attached to the spring by means of a clamping plate and two bolts. But, as three of the spring leaves are clamped together, inter-movement is checked and the spring acts, in effect, as one 6 in. shorter than the master leaf and as though the latter were in thickness equal to the three leaves.

Examples of Common Practice

The most widely used system is shown variously applied in Figs. 12 and 13. It consists of two approximately full-length leaves, of which only one is fixed to the axle, the other being allowed to move relatively by reason of the clamping plate taking effect upon the lower one alone. But it is not sufficient to prevent that corner of the frame from dropping if a master leaf should fracture; the safety leaf or its alternative must also keep the axle in approximately normal alignment. So in the Talbot design (Fig. 12) and in other examples not illustrated, the second leaf is slotted at each side where the clamping plate occurs and the amount of relative movement possible between this leaf and the axle is just sufficient to permit the two leaves to be flexed without restraint. In the example just referred to the isolated bolt passes directly through the end of the master leaf and the axle pad, the clamping plate being a supplementary means of securing the spring. But in the A.C. Six (Fig. 13), the clamping plate is held down on to the master leaf by all three bolts; the front one also passes through the slotted end of the second leaf, which, again, is permitted free relative movement due to flexion and yet is prevented from escaping if the master leaf should break.

Advantages of Quarter Elliptic Spring

Figs. 12 and 13, as well as others, show methods of attaching the butt ends to the frame and incidentally bring to notice an advantage of quarter elliptic springs as compared with most other types. That is to say, the inherent weakness in a half-elliptic, for instance, due to the presence of an assembly bolt at the center of the spring length, is eliminated. The majority of quarter elliptics have a combined assembly and anchorage bolt at the extreme end of the butt, where there is no risk of load and flexion causing stresses that might result in a fracture. The examples in Figs. 12 and 13 have this feature, though in other respects there is marked divergence in the mounting to the frame; in the former a bracket intervenes between spring and frame, the springs being parallel with one another, whereas in Fig. 13 the springs are splayed to make their mountings on the axle wider apart and an angle steel plate forms the bracket on the outward-facing channel of the frame.

The A. B. C. front anchorage (Fig. 14) embodies two full-length leaves, as well as a safety leaf. The clamping plate scheme previously mentioned appears to be preferable to the use of a pair of stepped bolts for fastening to the axle as shown, for two reasons: It affords a bigger area of spring surface gripped and does not call for the second series of holes in the leaves at a point where fractures would take place—there is, in other words, a weakening of the leaves in Fig. 14 just where they should be strongest, which probably accounts for the use of the additional leaf referred to.

The Singer Six

An altogether different arrangement is that shown in Fig. 15 (the Singer Six). Here there are again two full length leaves, but both are secured rigidly to the axle by a single bolt and clamping plate. The second leaf is, however, allowed relative movement by being narrowed at the butt end of the spring, the clamping bolts and plate at this end being prevented from clamping the tongue of this leaf by the presence of a distance plate at each side between the master and third leaves, these plates being slightly thicker than the second leaf. The only advantage attaching to this arrangement is that the whole width of both the full-length leaves is available to resist fracture adjacent to the clamping plate on the axle, whereas in the alternative scheme exemplified in Figs. 12 and 13, there is a narrowing of the upper of these two leaves at what is certainly a vital point in its length. While this narrowing may not be objected to when both leaves are intact it might well mean that if the master leaf fractured the other would follow suit immediately through being unable to carry the load unassisted even long enough to enable the driver to realize that the car at that corner was sagging and that something was amiss. The butt end of the spring is, admittedly, slightly weakened in the arrangement in Fig. 15, but only to an extent which should justify the loss being ignored.

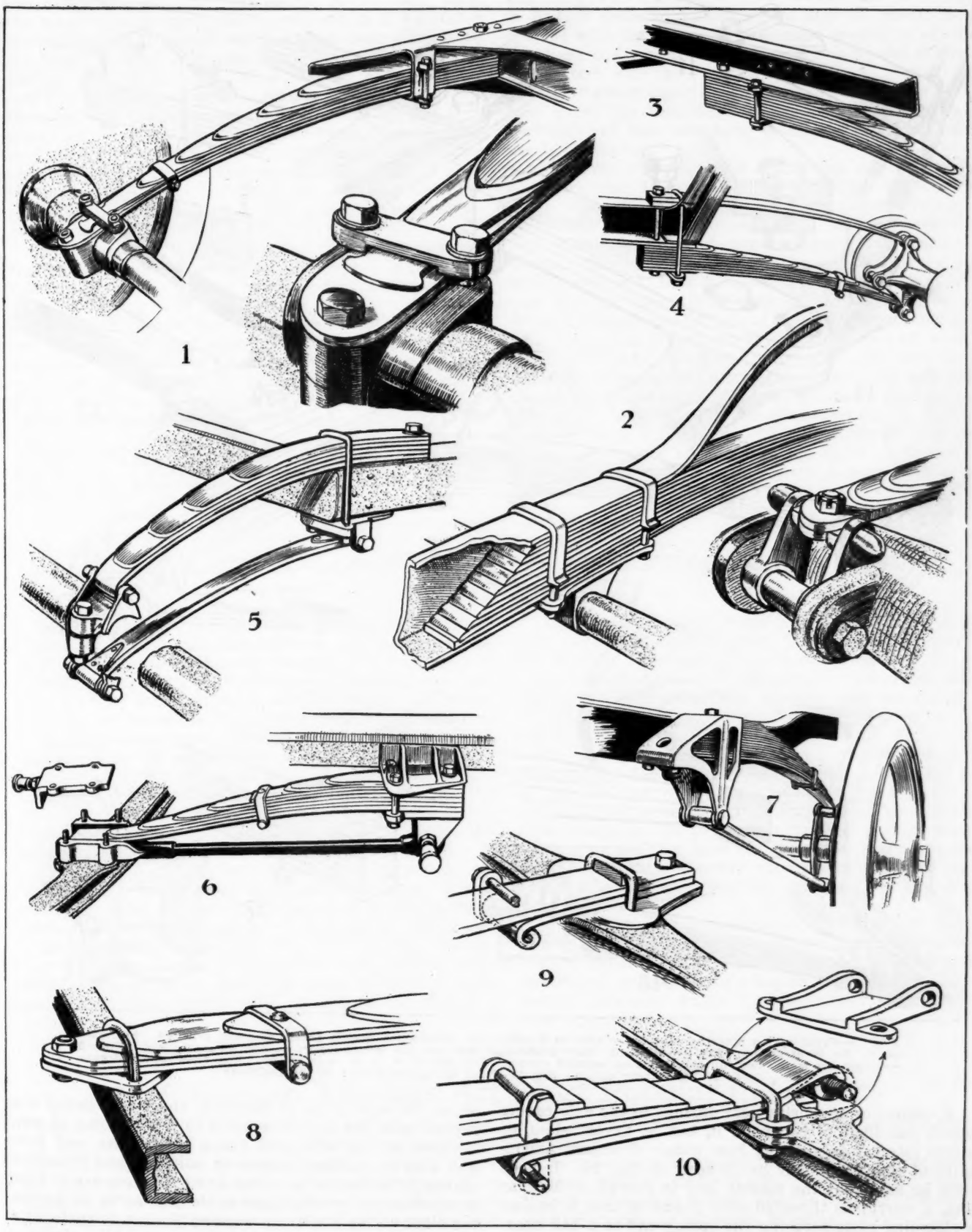


Fig. 1—Citroen scheme (rear) applied to tapering frame. Fig. 2—A. C. Six (rear) spring butt located in frame channel. Fig. 3—Standard method places rear spring under frame members. Fig. 4—Single blade from top of frame to bracket on rear of 7-hp. Wolseley. Fig. 5—G. N. spring blade used to provide parallel motion arrangement for front axle. Fig. 6—Front radius rod used on Carrow. Fig. 7—Turner use of radius rod (rear). Fig. 8—Standard (front) "safety leaf." Fig. 9—Seven-hp. Wolseley (front) spring plate integral with axle. Fig. 10—Fifteen-hp. Wolseley (front) longest leaf coiled

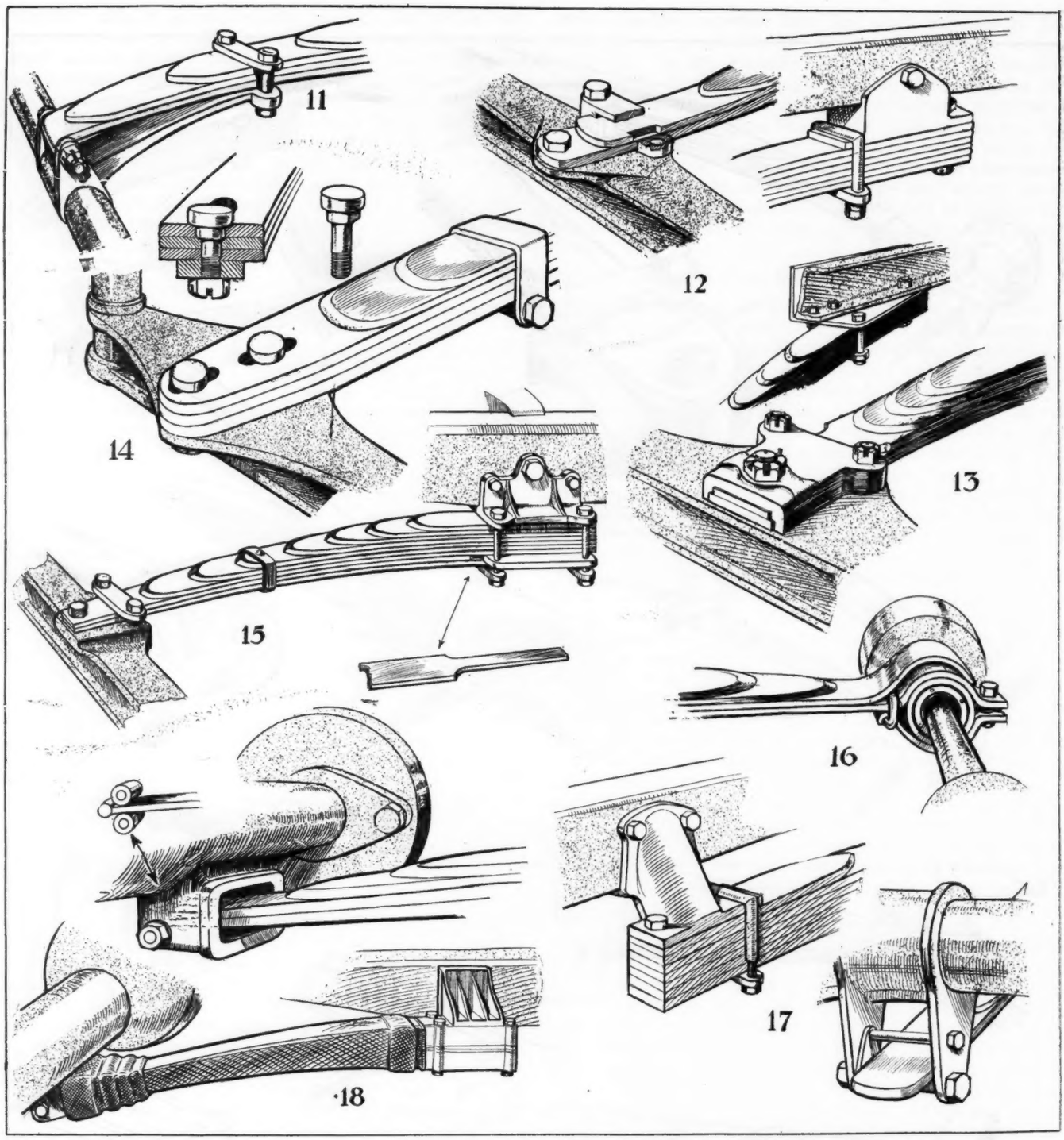


Fig. 11—Front spring attached to tubular axle on Rhode. Fig. 12—Talbot (front) shows common practice. Fig. 13—A. C. Six front spring. Fig. 14—A. B. C. front anchorage uses two full length leaves as well as safety leaf. Fig. 15—Single Six front, two full length leaves secured rigidly. Fig. 16—M. A. S. E. rear spring. Fig. 17—Front and rear ends of Talbot rear spring. Fig. 18—Rear spring mountings of the Galloway

A method of anchoring rear springs to the axle casing which has little to commend it, but is, nevertheless, of slight interest as showing how widely divergent assemblies at this point may be, is seen in Fig. 16. It need only be said that the master leaf is curved at its rear end, a stirrup is threaded over it and to this is hooked a clamping plate securing the spring end to a ball bearing on the axle casing; the second leaf is extended and its end curved to approximately the same radius as the master leaf.

The front and rear ends of the Talbot back spring are shown in Fig. 17; while there is nothing unorthodox about the anchorage of the butt, there is a detail connected with the axle bracket which is worthy of note. Located by the bolt upon which the master leaf rests, and also by another transverse bolt, are two triangular plates inside the horns of the bracket; these are of hardened steel, are readily renewable and serve to prevent the sides of the leaf from wearing the inside surfaces of the bracket horns, the latter being parts which obviously cannot be replaced without a lot of difficulty and expense. This is a feature that might well be applied to cantilever springs mounted in similar fashion.

The final illustration (Fig. 18) shows the mountings

of the rear springs of the Galloway, a light car made by the Beardmore interests. As shown in the lower view, the whole spring is completely enclosed in a well-fitted grease-retaining "gaiter" which extends over flanges on the frame bracket and a socket integral with the axle casing. Within the axle socket the end of the master leaf lies between two rollers, resting upon one which is threaded over the transverse bolt, of which the nut is in view; the tip of this leaf has a boss formed on it to prevent the spring end from becoming displaced if the spring should open out beyond the normal—for example, when the frame as distinct from the axle is jacked up. The spring can be withdrawn at this end only by first removing the lower bolt and roller.

In conclusion it may be said that the rapidly increasing popularity of the quarter elliptic spring is fully justified in practice. It gives results in passenger comfort fully in keeping with those of the cantilever, and compares favorably with any other type as regards cost; it has the same merit of reducing unsprung weight as the cantilever and its total weight is little if any more than half that of the latter.* It can be used with either Hotchkiss drive or a torque tube, and in its simplest rendering with the former all need for grease cups or oilers is eliminated. Shackles are not required in any case and there is no trunnion bearing to consider. It appeals to British users by reason of its ease of maintenance coupled with the degree of passenger comfort it affords. For light and medium-sized cars it has proved entirely satisfactory with the modifications from its original applications which experience dictated; in fact, some of the best if not the very best sprung of British light and medium-sized cars now have quarter elliptics and their use is increasing.

Admittedly its application and design call for careful consideration. It may, like the cantilever, cause a car to be prone to roll pronouncedly on corners taken at speed; but this tendency can be and has been overcome. One seemingly inherent feature appears to make the quarter elliptic unsuitable for the front of heavy and high speed cars; that is to say, its single point of support and the lateral flexibility of the spring give the driver an impression of lack of precision in steering control. This is an impression which soon wears off when a speed of 40 m.p.h. or so is not exceeded; but there is undoubtedly some lateral movement of the front axle relative to the frame under most conditions of running and this might well prove to be disconcerting, to say the least, at really high speeds. Up to the present this type of spring has not appeared at the front of British or European cars of over 20 hp.; where it is used on larger sizes it occurs at the back only.

*This statement is open to question, as for the same deflection per 100 lbs. increase in load (which determines the riding comfort) and with the same grade of steel and the same factor of safety the same amount of steel is required in a quarter elliptic as in a cantilever spring.—EDITOR.

Better Cars at Lower Price—A Production Achievement

(*Continued from page* 1149)

The close relationship and the interlocking interests between the designing, manufacturing and merchandising ends of the business constantly become more clear. Superimposed on all of these problems we have the detail considerations of such matters as the reduction in scrap, the reduction of industrial wage, the elimination of unnecessary operations and the elimination, particularly, of hand operations by the employment of machinery.

Labor situations sometimes arise which call for delicate tact and proper handling, so that justice may be done the men in the shop, and, at the same time, the costs of manufacture may not be run up to a degree which makes the product commercially unprofitable.

There is always a possibility of effecting savings by scanning new processes as they come into being. Pieces which have been sand cast, for instance, may often be made more economically by forgings or die castings. The quantities produced will, of course, be a factor in this. Stampings of certain circular shapes may be made better in automatic screw machines, and often parts which have been cast may be more economically made from bar materials or tubings.

Careful consideration should be given the new machine tools appearing on the market, to determine whether or not existing equipment cannot well be replaced by machines capable of larger production. Operations which require one or more general purpose machines should be studied from the standpoint of special purpose tools of higher capacity.

The average mechanic working in a shop represents the interest on a $20,000 investment, which pays at the rate of 6 per cent per year. If, by investing, therefore, in five machines which can be taken care of by one operator, these machines are paying for themselves immediately, whether or not they have cut the actual producing time. In all probability, however, such machines would materially save actual production time as well as direct labor wage.

In one particular department of an automobile factory producing at the rate of 30 cars per day it was recently found possible to take 35 per cent of the men out of the department and still have a higher production and consequently increased wages for the individual workers in this department.

American Tractors Are Most Popular in Greece

THE total number of tractors in Greece is about 500, of which about half are of American make, according to a report to the Department of Commerce. There are 150 track-laying tractors and 350 wheel type. Two hundred of the latter are of American make, 70 are German, 40 English, 10 French and the balance from Sweden and other countries. Germany is also supplying 40 tractors on account of war indemnity. About 70 per cent of the track-laying tractors are of British make. The others are French, Italian, German and American. Germany is to deliver 25 of this type on account of war indemnity.

The most popular among the European makes are the German "Stock" and "W. D.," the English "Wally," "Fowler," "Aveling Porter" and the Swedish "Excelsior." All these types do not seem, however, to have quite met the requirements of this market, which needs a small tractor of about 12 hp. to be used on the many small-sized farms. The types in use are too big for pulling one plow and to small for two plows.

Do Overhead Camshafts Increase Efficiency in Engine Operation?

Part II

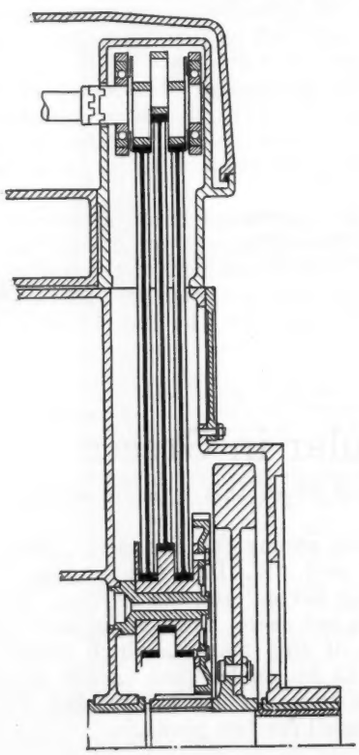
Europeans producing a number of overhead camshaft drives and overhead valve actuating mechanisms of very radical design. Leyland eight-in-line offers a good example of unconventional practice without regard to costs of production. Application of a more simple design found on the Rhode.

By P. M. Heldt

WE now come to a number of rather radical designs of overhead camshaft drive and overhead valve actuating mechanism which have become known through recent patent publications. One of the cars that has been talked of a good deal the past year and a half is the Leyland eight-in-line. On the engine of this car an eccentric mechanism is used for transmitting motion from a half-speed shaft located close to the crankshaft and driven by spur gear therefrom, to a short shaft normally in line with the camshaft. In order to obviate difficulties due to unequal expansion of the cylinder block and the eccentric rods the short shaft at the top has a support separate from the cylinder head and is connected to the camshaft by means of an Oldham coupling which compensates for any slight disalignment between the driving and driven members. The eccentrics are evidently set at angles of 120 deg. This drive ought to have something to commend it from the standpoint of continuity.

A still more radical design of valve gear has recently been patented in England by the Fiat Co. Upon the upper part of the valve stem is mounted a trunnion carrying two conical rollers. The trunnion is mounted between a shoulder on the valve stem and a coiled spring which is backed up with a nut and lock nut at the top of the stem. Surrounding the valve stem guide is a shell with opposite vertical slots through which the arms of the trunnion extend. On ball bearings upon this shell are mounted a pair of face cams upon the circumference of which are cut spur teeth. In the particular design shown there are four valves in the cylinder head and all of the cams are geared together. It is obvious that as the cams are revolved the valves are opened and closed positively, except for the slight play of the springs. A valve gearing of this type should permit of very high engine speeds, but the cost of manufacture is undoubtedly quite high.

As regards the operation of the valves from overhead camshafts, there are at present three methods in vogue. The cams may either act directly on cam followers secured



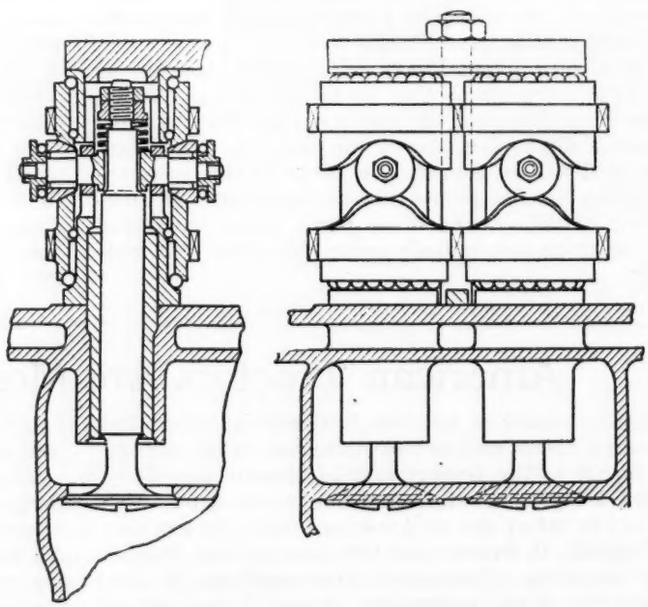


Fig. 10—(Left)—Leyland straight eight camshaft drive (sketch)

Fig. 11—(Above)—Fiat camshaft

SIDE GUIDE AND GRIPPER

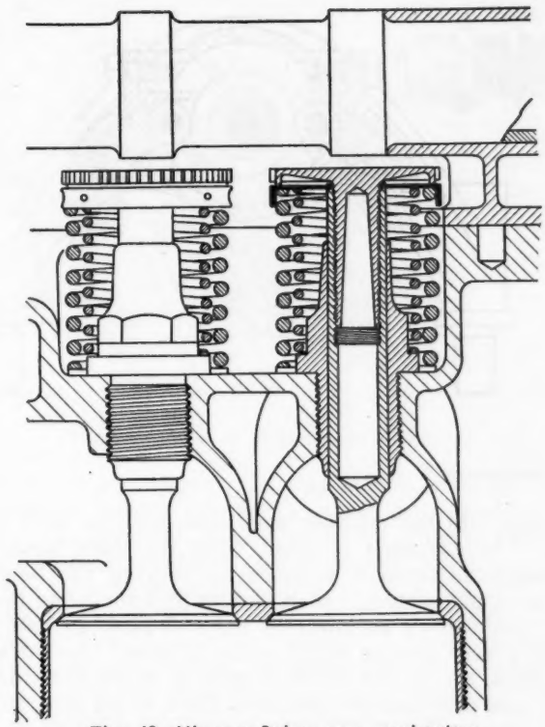


Fig. 12—Hispano-Suiza cam mechanism

to the end of the valve stem, as in the Hispano-Suiza engine; single armed levers or adjusting blades may be interposed between the cams and the valve stems, or the cams may act on the valves through the intermediary of tappet levers as in the Liberty aircraft engine.

With the first mentioned arrangement the means for adjusting the valve clearance must be provided on the valve stem itself. This problem was solved in a rather neat manner by Birkigt, the designer of the Hispano engine. He drills out the valve stem and inserts a screw with a flat head with slotted rim. Underneath the screw head is a washer which has splines or keys on its inner circumference that engage into slots in the end of the drilled valve stem, so that the washer can slide longitudinally on the valve stem a limited distance but cannot rotate with respect to it. The valve spring presses the washer strongly against the screw head, and the screw is thus locked. On the circumference of the washer there are several radial drill holes, and a pin wrench is provided which engages into the holes and slots of the washer and screw head and permits the adjusting screw to be screwed farther into or out of the valve stem.

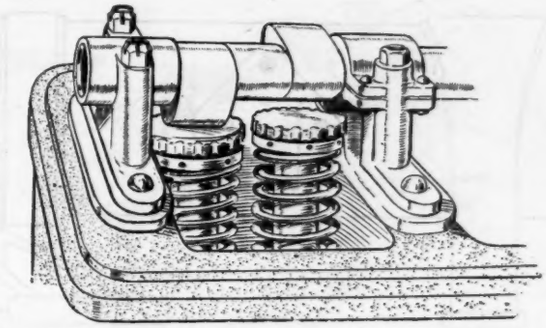


Fig. 13—Sketch of Hispano-Suiza cam mechanism

Fig. 14 shows the system applied to the British Dawson car (now defunct). As will be seen, it resembles the Hispano in being of the direct acting type and has similar means for valve clearance adjustment; despite the prevalent idea that Hispano claims a master patent on direct operation, Dawson continued to turn out engines with this type of valve system without serious interference for a couple of years. The failure of the firm was not ascribable in any way to the type of valve gear used on the engines. The scope of the Birkigt (Hispano) patent apparently includes only the particular means of adjustment, including the pin wrench.

It is, of course, quite possible to arrange overhead valve mechanisms in a way similar to the mechanism used with the ordinary L head engine. That is, between the valve and the camshaft can be placed a pushrod provided with an adjusting nut or adjusting screw and lock nut. The objection to this construction is that it gives an abnormally high engine. An overhead camshaft engine is much higher than an L engine in any case, and if a pushrod is placed between the valves and the camshaft the height of the engine is increased by the length of the pushrod. There may be instances where this is of no great consequence, as where a very small engine is placed under a normal sized hood, but in most cases it would be objectionable.

Bugatti developed an overhead valve gear which overcame this objection. He uses curved push rods (quadrant shaped) with rollers at both ends. The cams on a camshaft centrally over the engine press against one of these rollers in a horizontal direction, while the other roller presses vertically down upon the valve stem. The quadrant shaped push rods were located in guides that were bolted to the sides of the cylindrical camshaft housing with three bolts. The design here illustrated is an early one. But the curved pushrod construction has been retained by Bugatti in a modified form. In this early design

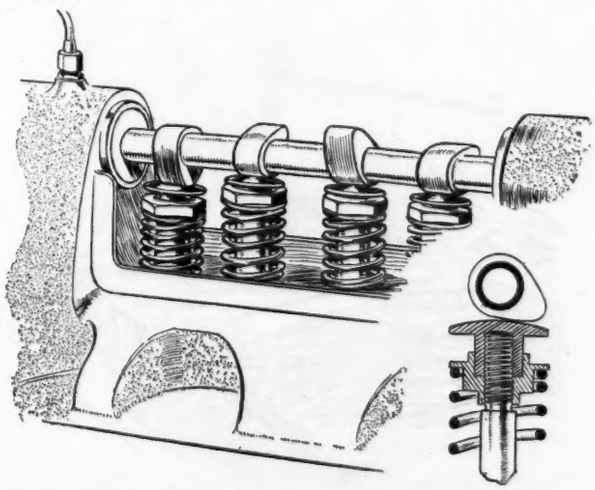


Fig. 14—Sketch of Dawson cam mechanism

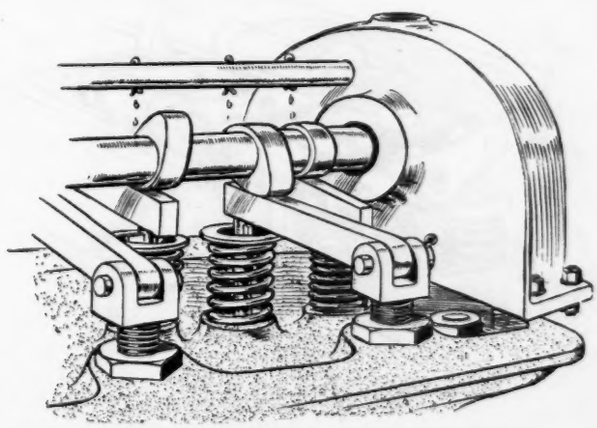


Fig. 16—Sketch of Rhode cam mechanism

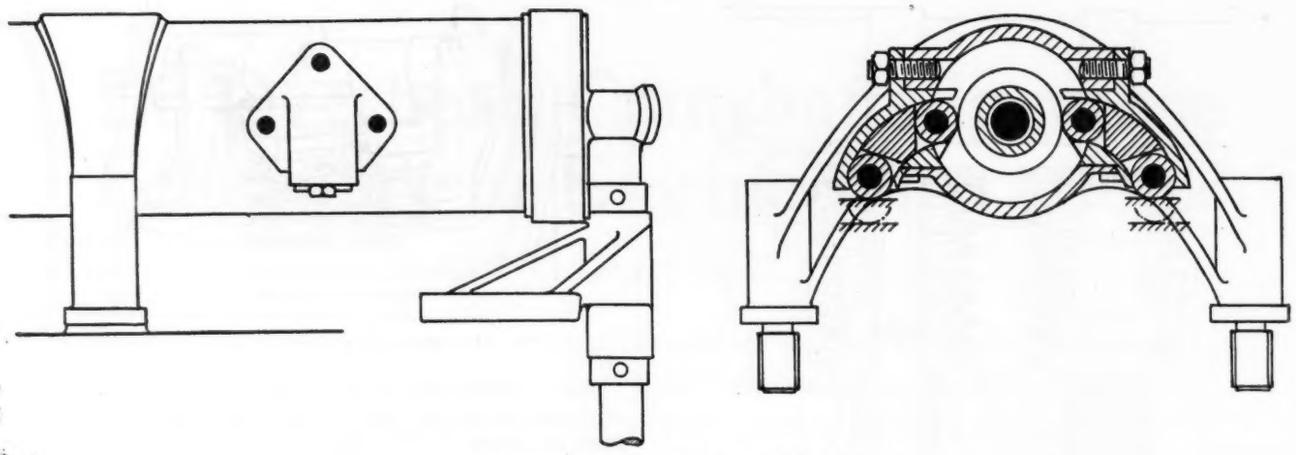


Fig. 15—Bugatti valve mechanism

the provision for the adjustment of the clearance apparently consisted in the use of shims under the pushrod guide. Very frequently in recent designs the valves in the head are placed at an angle with the cylinder axis, one valve to each side of the central vertical plane of the engine, and the camshaft is then placed centrally over the cylinder heads, which makes for symmetry. On smaller engines, however, the plan of setting the valves at an angle is not so practical, for it calls either for a wide cover or else makes it necessary to leave the valve springs unprotected and have the tappet levers extend through the walls of the cover. In aircraft engines this latter practice is widely followed, because dust and dirt are seldom a factor to be figured with in that line, and the additional noise also does not count. In passenger car engines vertical valves seem to be preferred, and in order to make it possible to operate these valves from a central camshaft single armed instead of double armed tappet levers are used. The two valves are sometimes placed on opposite sides of the longitudinal center plane of the engine and are offset in the fore and aft direction sufficiently so that the two levers do not interfere. This arrangement permits the use of comparatively long lever arms, which reduces the side pressure on the valve stems, and at the same time enclosure of the entire mechanism in a compact housing.

One of the simplest, in fact crudest, overhead camshaft applications is that of the Rhode (Fig. 16), a British light car with a four-cylinder engine of 67 cu. in. capacity and selling at a low price. Its camshaft is driven by a train of helical pinions and actuates the valves through levers of rectangular stock pivoted on adjustable standards screwed into the cylinder head and provided with a lock nut. The camshaft is offset from the valve stems, and clearance adjustment is made by varying the height of the pivot pin centers, which implies first removing the pins and then raising or lowering the standards in half turns —not a very precise means of adjustment. As the sketch indicates, this is one of the outfits in which individual oil drips are provided for the cams from an oil pipe running from one to the other of the pressure fed camshaft bearings.

A British chassis of moderate price with a four-cylinder engine of 180 cu. in. capacity having an overhead camshaft is the 18-hp. Phœnix, of which the valve operating details are shown in Fig. 17. This also has pivoted levers interposed between the valves and an offset camshaft, but the levers in this case are built up and somewhat resemble the links of a roller chain; in fact, the cam makes contact with a roller on the intermediate crosspin. Provision for clearance adjustment consists of cap nuts on the valve stems; the lubrication system includes pressure feed to the shaft bearings and separate drips onto the cams from a longitudinal pipe not shown in the sketch; the drive is by helical gears and a vertical shaft with a dog coupling having offset jaws to insure correct reengagement within limits.

The Beardmore (Fig. 18) also comes within the pivoted lever class with an offset camshaft, though in this case the levers for inlet and exhaust valves respectively are pivoted on opposite sides of the cylinder heads as shown. Lubrication details are similar to the Phœnix. Small leaf springs are fitted to prevent chattering of the levers, and pairs of the latter are separated on their pivot shaft by

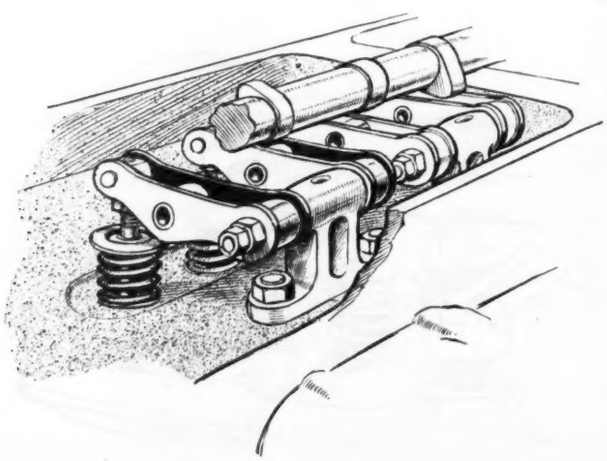


Fig. 17—Sketch of Phoenix cam mechanism

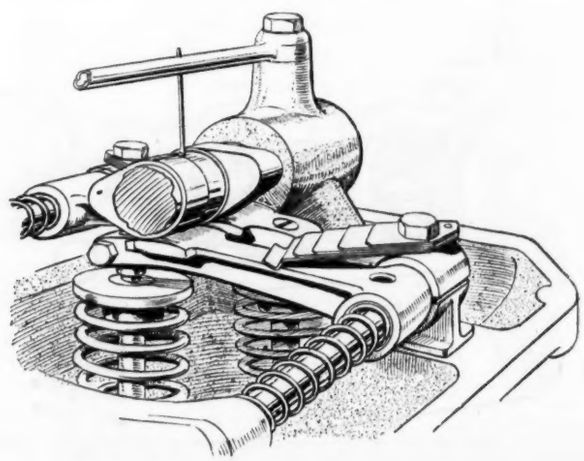


Fig. 18—Sketch of Beardmore cam mechanism

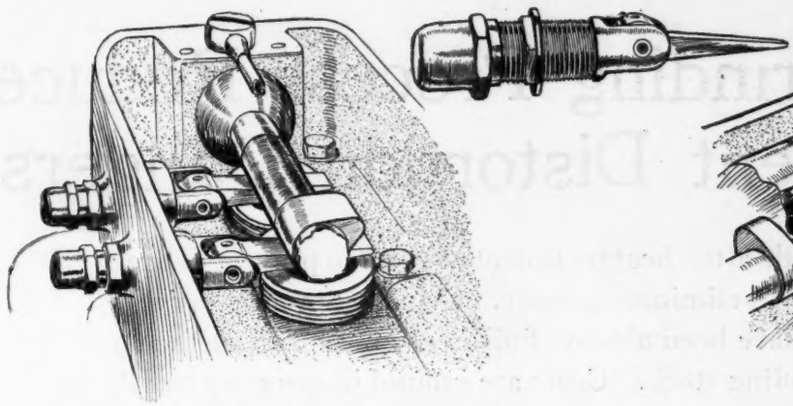


Fig. 19—Sketch of Diatto cam mechanism

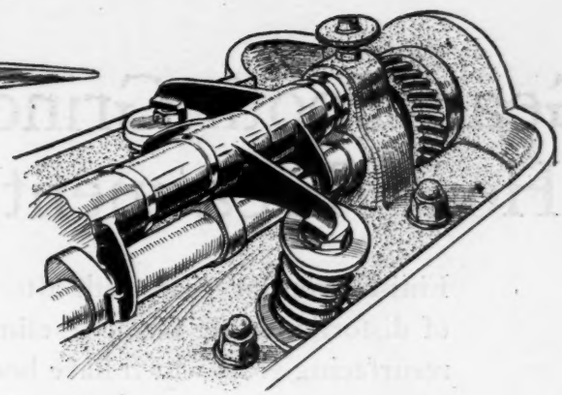


Fig. 20—Overhead camshaft Ansaldo

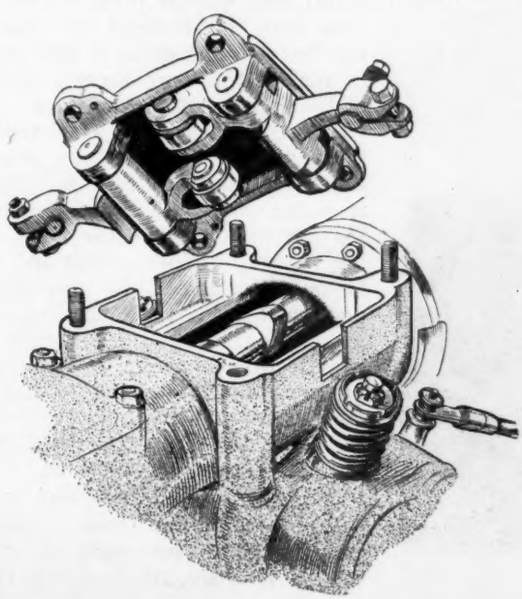
helical springs to take up end play and to allow the levers to be moved to one side to facilitate valve removal and clearance adjustment—the means to the latter end consisting of threaded studs in the lever ends making contact with the valve stems and locked by a pinch bolt.

A design of distinct interest is that of the Diatto (Fig. 19) which has pivoted and tapered tongues interposed between cams and valves, the camshaft center being immediately over the valve stem centers. Clearance adjustment is effected by moving the tongue towards or away from the camshaft center line, the horizontal supports being threaded, located in clearance holes and locked by nuts in the wall of the overhead valve chamber as shown in the sketch. Without being crude this is a simple design which should lend itself to economical production far better than a good many overhead camshaft arrangements. The angularity of the tongues must be considerable at full valve openings and be liable to result in undue side thrust on the valve stems; but there appears to be no valid reason why the tongues should not be longer and pivoted farther away from the valves to reduce angularity and side thrust. With efficient lubrication the wear of the tongues should not be excessive, and in any case the latter could be made easily and cheaply renewable.

Typical of many other overhead camshaft designs, the Ansaldo (Italian) shown in Fig. 20 is in the class embodying rocking levers with bearings on a shaft immediately above and running parallel to the camshaft from end to end, with the valves on opposite sides of the cylinder head. The valves are usually, as in the Ansaldo, outwardly inclined at a slight angle from the vertical. Although in the case illustrated the clearance adjustments are on the valve stems, set screws and pinch bolts in the outer ends of the rockers are more favored.

The Straker Squire arrangement (Fig. 21) is unusual in two respects. In the first place it is used on a six-cylinder engine with separate cylinders and in the second place the valves on opposite sides are outside the camshaft casing. The sketch is practically self-explanatory, except that it does not show that the camshaft casing is a unit casting running from end to end of the cylinders, being secured to the latter by the studs and nuts that hold in place the individual cover plates bearing the roller ended rockers. The drive in this case is by bevel gears at each end of a vertical shaft.

Still more unconventional is the Leyland eight-cylinder-in-line overhead camshaft gear (Fig. 22), the drive for which has been described in the foregoing. Only one cam is used for the inlet and exhaust valves of each cylinder, the cam acting upon slipper followers pivoted to built-up rockers. The latter at their outer ends bear upon T pieces screwed into the hollow valve stems, while the springs are semi-elliptic laminated units forked at their ends to engage with and exert a lifting pressure on the T pieces and through them upon the valves. With a total disregard for cost of production (the Leyland at $10,500 for the chassis is the most expensive British car) the designer has evidently aimed at securing silent operation by endeavoring to prevent valve spring rebound, and so has adopted the laminated type. The pivoted slipper followers may also have appeared to hold out possibilities in the same direction, but by being satisfied with the compromise valve opening diagram which is obviously necessitated by using the same cam for inlet and exhaust, he would seem to have taken away any gain in efficiency induced by overhead valves.



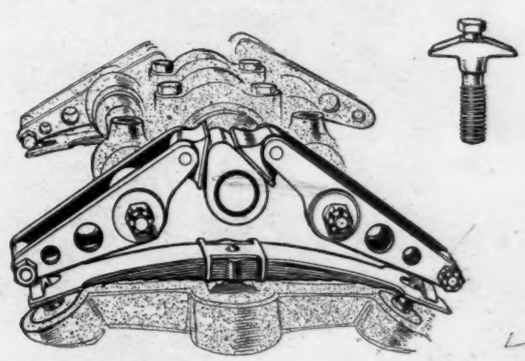


Fig. 21—(Left)—Straker Squire cam mechanism

Fig. 22—(Above)—Leyland cam mechanism

Gear Tooth Grinding Process Reduces Heat Treatment Distortion Dangers

Finish grinding gear teeth after heat treatment of gears to prevent danger of distortion a big factor in eliminating noise. Grinding process permits resurfacing gears which have been already finish cut to size and surfacing of gears which have grinding stock. Gears are ground in gauge up to 12.

THE recent great increase in closed cars has been responsible for a renewed activity in commercially manufacturing transmission gears which will be sufficiently accurate to give silent transmissions. It is a well-known fact that gear noises are magnified in closed cars. It is necessary that the gears be quiet, both while loaded and while idling. It is also recognized that gears which are initially quiet are possessed of a much longer life than the noisy gearing, which indicates badly shaped teeth and consequently tooth shock, which is responsible for increased wear.

It is, of course, a well recognized fact that one of the reasons for noise is the distortion of the tooth form (due to high temperatures required in the heat treating processes). Furthermore, considerable vibration and noise has resulted from the efforts to secure the lightest possible gear, in order to reduce the inertia of the transmission part to the greatest possible degree.

A short review of previous attempts in gear grinding will be of interest. The earliest efforts of which we have record was made by a gear foundryman as early as 1874. Emery wheels are described in the patents filed showing the wheel molded to the approximate shape of the tooth space. This wheel passed between the teeth, removing some roughness and burrs. This, however, was simply a roughing operation intended to replace the hand trueing which had previously been done with files or with a chipping hammer.

The next effort of which we have record is the Leland-Ferris bevel gear grinder, shown by the patent files in 1898, at which time the edge of the wheel was used with a generating type of machine to form a surface on a bevel gear tooth. About this same time Cheney developed a similar machine very little different from the Leland-Ferris type.

About 1891 the Fellows company produced a generating type of machine, showing detail changes from the previous work done by Leland and Cheney. A machine was also developed in Germany by the Reinicke Company of Chemnitz. These machines used the side of the emery wheel and generated the gear tooth form.

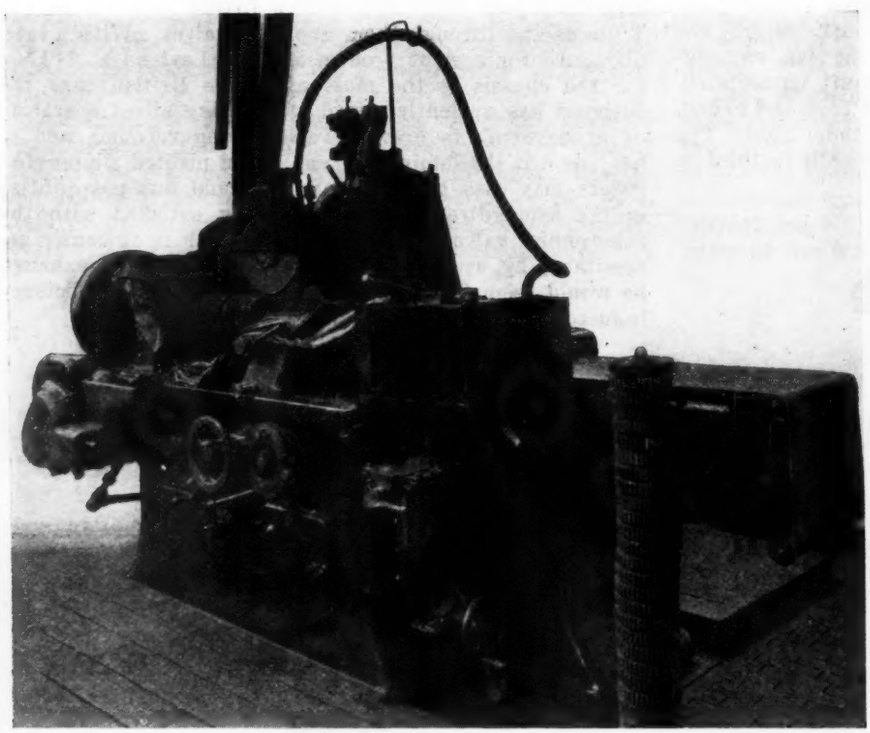
To-day we have in this country generating types of machines made by Pratt & Whitney, Garrison and Lees-Bradner. Another type of gear tooth generator is shown in the patent of the Brown-Lipe Co., issued to A. T. Brown in 1914.

The method to be described herewith was developed by engineers of the Gear Grinding Machine Co., the fundamental behind whose method is the reproduction of the gear tooth form upon the wheel from master forms. It is a feature with this method that the wheel can be re-trimmed in a few moments to replace the worn form without loss of the setting of the machine.

It is claimed that with the Ward gear grinder as used by the Gear Grinding Machine Co. it is possible to trim the wheel and use it for a roughing operation around the gear, removing the serious inequalities and the extreme distortion of the heat treatment and then to re-trim the wheel with great accuracy and remove from the gear teeth a finishing cut of very small amount. This is claimed to give a perfect reproduction on the tooth surface of the master form from which the diamond trimmers are operated.

In this method the wheel normally passes between two teeth, finishing adjacent sides of two teeth and the bottom of the space, although it works with

*Condensed from a paper by R. S. Drummond of the Gear Grinding Machine Co.

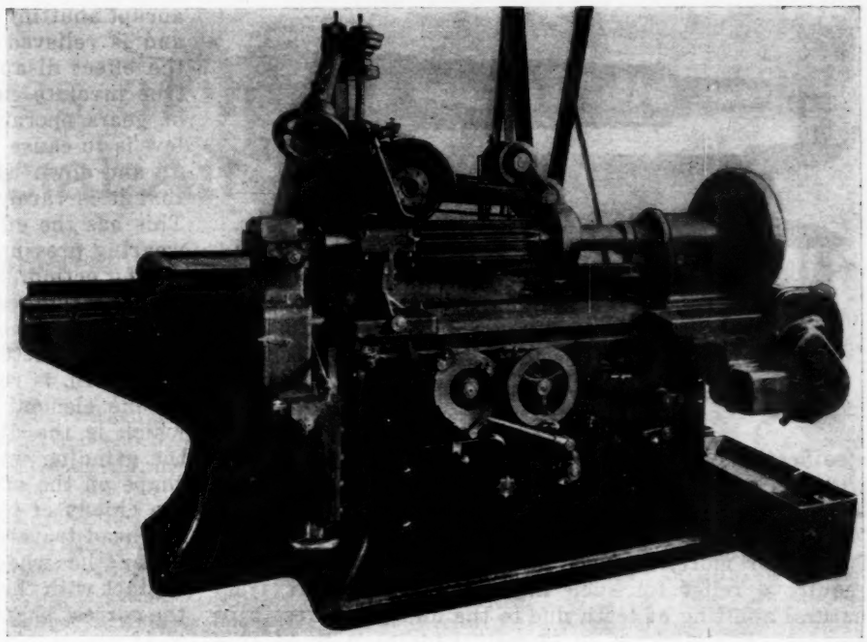


1—Grinding the teeth on ten spur gears at one time

facility on one side of one tooth without grinding the adjacent side of the next tooth if desired.

There are two distinctive uses which are claimed for the grinding process for finishing gear teeth. These are (1) the resurfacing of gears which have already been finish cut to size and (2) the surfacing of gears which have grinding stock, or, in other words, which are manufactured in part by cutting machines and then ground to finish size.

A large volume of business in resurfacing gears was done during the first five years of the company's operations. The process was used principally to salvage parts which had not passed inspection. These gears had failed either because of malformation of the teeth or distortion of their shape in heat treatment. But what apparently is by far the most promising use for the finish grinding of gear teeth is in those which have been rough cut, leaving a grinding stock. To-day this constitutes the largest volume of gear tooth grinding. Automobile transmission gears are required to operate noiselessly at high speed and to show but small wear. Perhaps the biggest feature in this connection is that the gear tooth is finished after the gears are heat treated and, consequently, without danger of distortion.



2—Gear Grinding Machine Co. planer type of grinder in operation

What Causes Noise?

It is very interesting to note what causes gear noise. One must consider that in a gear making tooth contact 14,000 times per minute, irregularity of contact will cause peculiar sounds. Many improperly shaped teeth cause an abrupt acceleration of the mating gear and equally abrupt slowing down. This reversal of acceleration occurring thousands of times per minute gives a sound harsh to the human ear and produces rapid wear.

A most common error is misplaced involute curves and irregular surface contact which cuts the oil film. When the shape of the involute curve is considered and it is realized that near the base circle the shape is approximately radial, whereas at the top it is very much rounded and falls away rapidly from a radial line, and then considers that a curve may be misplaced downward as much as .005 in., it is possible to realize the severe effect at the top of the tooth. In a recent case of this kind idler gears were ground accurate with the bore, but were noisy in the assembled transmission. Upon inspection of the idler, it was found to be bushed and the bushing was eccentric, causing the tooth form to be high on one side and low on the other. The noise was not a sound of eccentricity, but rather a low growl. New, accurate bushings eliminated the noise. One interesting feature of this transmission was that one idler, which was cleaned up accurately with the tooth position and which was a loose fit on the shaft, was relatively quiet.

As a sample of the stock removed from gear teeth by the grinding process, some figures bearing on gears similar to those in automobile transmissions may be mentioned. These gears varied from 2 to 8 in. in diameter, from 6 to 7 pitch and ⅝ to 1¼ in. face width. On such gears it is usual to correct the tooth curve and give a good finish to the tooth surface by the removal of approximately 0.003 in. from each side of the tooth. Where the inaccuracies of machine work or the distortion of heat treatment is excessive, it sometimes becomes necessary to remove as much as 0.006 in. from the surface of the tooth on both sides. The removal of this amount of stock 0.003 to 0.006 in. will remove from the thickness of each tooth from .006 to .012 in., adding that much to backlash in a given gear. Double this amount is added in a pair of gears meshing together. We find that on the average we can expect the backlash to increase 0.010 to 0.015 in. in a pair of commercial transmission gears, due to the removal of stock by the grinding process.

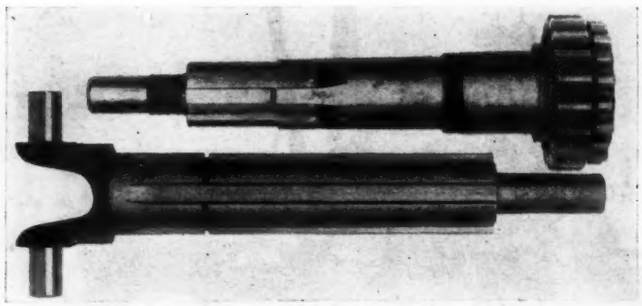
The depth of case hardening of such gears is usually specified as 0.035 in. or more, is amply sufficient to permit of the grinding of gear teeth for salvage purposes without alteration of case hardened limits. Some manufacturers prefer to make the case 0.040 in. deep, and this has proven entirely satisfactory.

For a long time manufacturers held the backlash between gears so close, say, 0.004 to 0.006 in., that a serious oil hammer was evident, especially in cold weather. In the normal operation of gears 0.015 in. backlash has been found highly satisfactory in high grade transmissions. The only unsatisfactory result of additional backlash comes from the accumulated backlash between a series of gears where the driven member overruns the driver, as in a car coasting against the engine, which will accumulate the backlash and cause the gears to tap against one another with a single distinct tap, which is normally not objectionable in automobile transmissions. It is unusual for drivers to continuously surge their cars backward and forward.

Necessary Machine Limits

In the rapid and economical operation of grinding gear teeth, certain machine limits are important. In automobile transmissions the limits on the bore of the gear should be set at .000 minus 0.001 in. plus specified size. The hub face may be permitted to run out 0.001 in. The outside diameter may be permitted to have a run out of 0.005 in. in gears from 2 in. to 8 in. in diameter. Index error may be permitted in a rough machine product up to 0.003 in. Such discrepancies in the rough product are well within ordinary limits of machine production.

The only tooth form of importance is the pure involute curve. Experience has shown that the closer the form of the tooth is held to the accurate involute form without



3—(Above)—Splined shaft which has been ground by Gear Grinding Machine Co. This piece must be very accurate, so that the universal joint will be co-axial with the shaft
4—A piece requiring grinding on the teeth as well as on the splines

modifications the better the gears operate. Ground gears with accurate tooth form will operate silently unless other features of the construction produce noise.

Gear teeth of 6 or 7 pitch and a pressure angle of 20 deg. or more, as used in automobile transmissions, require a relief for such interference as occurs from natural abutting of teeth due to the numbers of teeth in contact. For instance, in 13 teeth running with 14, this abrupt abutting of the teeth is due to the number of teeth and is relieved by increasing the pressure angle until the effect disappears. Teeth accurately formed to the true involute curve will operate accurately. The effect of gears operating with curves placed too high or too low is to cause the gears to move with a speed varying up and down with each tooth action. Another effect is that it is rarely possible to secure double tooth action. This has the effect of giving the full driving force as a wearing pressure on the tooth at the period of greatest sliding action.

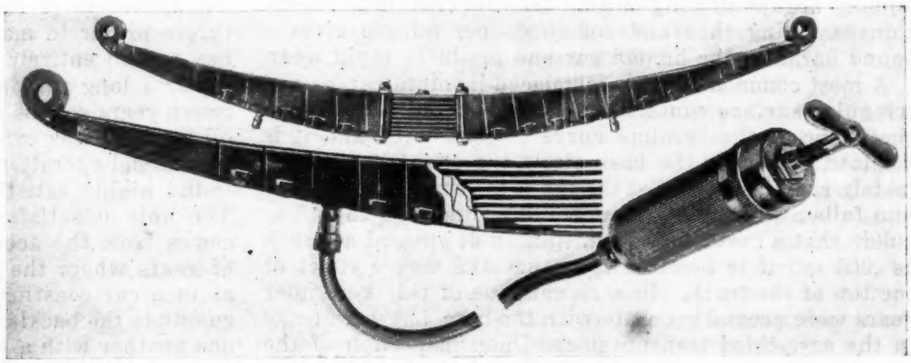
The machines used by the Gear Grinding Company employ a formed grinding wheel. With this grinding wheel a predetermined shape, as established on a form or pattern, is reproduced. This form or pattern is used as one element of a pantograph, the other extreme of which is the diamond point which scribes the side of the grinding wheel to an accurate shape similar to the shape on the master form. The machines in use to-day are chiefly of the shaper or planer type; that is, either the head traverses over the work or the work traverses under the wheel, the grinding wheel thus coming in contact with the faces of the teeth and grinding them to the correct shape. The gears are ground in gangs of up to 12.

Metallic Cover for Chassis Springs

ABOUT ten years ago the practice of enclosing the chassis springs in a leather boot to protect them against mud and dust was introduced in England. Recently the plan has gained quite a foothold in this country also, though the covers are usually of imitation leather or rubberized fabric and in the majority of cases particular attention is paid to the problem of keeping the leaves supplied with lubricant. These spring covers are either laced or buttoned on, and when the supply of lubricant is to be renewed they must be unlaced or unbuttoned.

To facilitate the operation of replenishing the oil supply in the cover, the Bassick Mfg. Co., originators of the Alemite lubricating system, have placed on the market the Alemite lubricating spring cover, which is entirely of metal and can be refilled with grease by means of the Alemite grease gun.

This spring cover is claimed to form a noiseless, flexible armor of lead coated, non-rusting steel, in which the spring works in a bath of lubricant that penetrates between the leaves. The cover is equipped with Alemite fittings and can be easily filled with the Alemite high pressure compressor and hose. The cover, it is claimed, excludes all water, dust and grit, and in conjunction with the lubricant bath prevents rust and friction.



Alemite lubricating spring cover

An Asbestos Brake Lining of Radical Construction

A NEW brake lining, composed almost entirely of asbestos, differing from most brake linings which are woven and contain a good deal of cotton and some rubber and copper wire, the latter giving the material the necessary tenacity, is being manufactured by the Nanbestos Products Co.

Nanbestos lining consists of asbestos mixed with a small proportion of a binder, and the necessary strength to enable it to withstand the breaking stresses is furnished by a sheet brass backing to which the asbestos is molded. The brass strip is formed with small tangs, which extend into the asbestos, and the complete lining is secured to the brake band or shoe by means of solid rivets.

A number of advantages are claimed for this lining as follows: Owing to the absence of cotton and rubber the lining withstands higher temperatures than the ordinary woven lining; the lining forms one solid mass and is impervious to oil and water; not being composed of layers, it will not disintegrate and cast off lint.

More Business at Less Cost Marks Commercial Aircraft Growth

Survey shows distinct progress made in 1921. Practical utility definitely demonstrated. Expansion averages about 20 per cent. A compilation of commercial aircraft operations in 1921 is here presented in detail.

IN the year 1921 progress in aviation was marked by three outstanding events, one of universal and epochal importance, the other two of more national significance.

During June and July there were held, 100 miles off the Virginia capes, a series of experiments in the course of which aircraft flown from land bases bombed and sank, one after the other, a submarine, destroyer, light cruiser and dreadnought, the most modern examples of warship construction.

In the fall the Conference on the Limitation of Armament was held in Washington, and it is asserted that the bombing tests cleared the way, more than any other single event, for a possible solution of the international competition in capital ship construction. For the 2000-pound TNT bomb which crushed in the steel walls of the *Ostfriesland* was, as the Army Chief of Ordnance remarked at the moment, "heard around the world."

Commercial aviation, struggling for nearly three years without assistance of a national policy, found an intelligent and sympathetic friend in the Harding administration. The President in his inaugural address urged the early enactment of an aerial code and the consistent encouragement of civilian flying. In consequence there was drafted a bill regulating the operation of aircraft in interstate and foreign commerce, and establishing a Bureau of Civilian Aeronautics in the Department of Commerce. This bill, introduced by Senator Wadsworth, passed the Senate, and at the time of publication of this volume was before the House Committee on Interstate and Foreign Commerce.

Aeronautical Chamber of Commerce of America

Possibly the most definite proof of growth in interest in commercial aviation, was the establishment, late in the year, of the Aeronautical Chamber of Commerce of America. The need for such an organization had long been felt. With definite assurance that an Aerial Code would shortly be established, manufacturers of heavier and lighter-than-air craft, motors, parts, accessories, materials and supplies; dealers, distributors, operators and owners; associations, corporations, firms and individuals engaged in the commercial phases of the art, decided to equip themselves with a national organization of the type which had proved so useful in the development of other American industries.

The Aeronautical Chamber of Commerce was incorporated under the laws of the State of New York, "to foster, advance, promulgate and promote" aeronautics, and "generally to do every act and thing which may be necessary and proper for the advancement" of American aviation. Formal organization was announced on December 31, 1921.

Commercial aircraft in 1921 definitely began the demonstration of practical utility. More miles were flown, more paid passengers booked and more package freight and goods carried.

Comparative Commercial Aircraft Operations, 1920-1921

	1920	1921
Estimated number of aircraft in operation	1,000	1,200
Estimated total mileage	6,000,000	6,250,000–6,500,000
Operating companies reporting	88	125
Equipment of these companies	365–425	500–600
Mileage flown by these companies	3,136,550	*2,907,245
Number of passengers carried	115,163	122,512
Pounds of freight carried	41,390	123,227
Number of flights by operating companies	Unknown	130,736
Average duration of flights	Unknown	21 minutes
Average charge for short flights	$12.50	$9.00
Average charge per mile for inter-city flights	.65	.55
Average charge per pound for freight	Unknown	.33
States in which operations were carried on	32	34
Air terminal facilities	128	146

(*Decrease explained by less free and more paid flights.)

Approximately one-half the equipment was controlled by established organizations, the other half being in the hands of the gypsy flier. It being known that the operators at fixed points covered approximately 3,000,000 miles, carrying about 122,500 passengers, it is estimated that, all told, rather more than 250,000 persons flew and that, counting the wanderings of the gypsy, 6,500,000 miles were compassed by commercial aircraft during the year.

New Aircraft Operators

Operation in states shows that the pressure upon the surface facilities in Illinois, Massachusetts, New Jersey, New York, Pennsylvania, etc., has encouraged the establishment of eighteen new aircraft operators, all of which engage in occasional transport between cities, but which are handicapped in their endeavors to establish regular service by the absence of landing facilities, properly disseminated weather reports, and aerial law which is primary to the legitimate general capitalization.

In California, Idaho, Iowa, Kansas, Kentucky, Maine, Missouri, Montana, Nebraska, Nevada, North Dakota, Oklahoma, South Carolina, South Dakota, Texas, Virginia, and West Virginia, where distances are great and surface facilities backward, commerce is willing to utilize aircraft. For the same service which appeals to the great business establishments of New York or Chicago, eager to hasten delivery and speed collection, appeals likewise to the small community the progress of which manifestly rests upon the rapidity with which it releases itself from isolation and establishes quick contact with purchasing territory hitherto unattainable.

The following pages contain a very complete table of commercial aircraft operations in the United States in 1921. This table was compiled by the Aeronautical Chamber of Commerce of America, Inc., and gives a comprehensive idea of the location, facilities and operations of all established commercial aircraft concerns.

Commercial Aircraft Operations in the United States, 1921.

(Compiled by Aeronautical Chamber of Commerce of America, Inc.)

Name of Company	Address	Air Port Facilities	Shop and Repair Facilities	Equipment	Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per Lb. of Freight	Operating Territory	Charge per Mile—Inter-city Flights
Adams Aircraft Co.	Oklahoma City, Okla.	Field (leased), 80 acres; hangar 50x75.	Limited	2 L.S. (W. 150 hp.)	1,000	30 min.	45,000	1,750	0	$10.00 to 15.00		Oklahoma City, Ardmore, Tulsa, Okla. and Dallas, Tex., etc.	$.75 (Minimum within 300 miles—25.00)
Aeromarine Airways, Inc.	Times Bldg., New York, N. Y.	Terminals: Keyport, N. J., New York, N. Y., Atlantic City, Key West, Havana, Palm Beach, Miami, Bimini, Nassau, Tampa, St. Petersburg, Belleair Heights, Fla.	Excellent — Keyport, N. J.. Key West, Fla.	8 A.—Navy 11-pass. Flying Cruisers. (L. 400) 17 A.—Navy H.S. 5-pass. Flying Boats. (L. 400) 5 A.—30 place Flying Boats. (L. 400)			95,020	6,814	24,002	5.00		N. Y.-Atlantic City and intermediate points; N. Y.-Havana; Key West-Havana: Miami, Palm Beach; Nassau, Bimini, Tampa, Belleair Heights, St. Petersburg and Key West; Great Lakes region; N. Y.-Albany: Lakes George and Champlain-N. Y. and New England Coast	
Aero Club of Miles City	Miles City, Mont.	Use Government Reservation. 3000x4500.	Use repair shop in town	1 J.—1 (OXX2) 1 J.N.—4-D. (OX5)	3,000	25 mm.	85,000	1,000	0	10.00			.33⅓
American Airways	College Point, N. Y.	Field (leased); hangar 65x100, two floors.	Complete for any airplane job	1 H.S.—1 Flying Boat (L. 400 hp.)	200	15 min.	4,000	600	0	.75 to 1.00 per min.			
Ashmusen Aeronautical Co	65th & Center Sts., Omaha, Nebr.	Field (municipal). 40 acres. hangar 80 x100.	First class, all types aircraft	1 *Blue Bird* (5-pass. 300 hp. Sal.) 1 U.E. Plane (150 hp.) 1 J.N.-4-D. (OX5) 1 J.N.-4-C. (OX5)	1,000	30 min.	40,000	2,500	very little	5.00	.12½ per 100	No established routes	.20
Aurora Aviation Co., Inc.	Aurora, Ill.	Field (leased). 66 acres, hangar.	Minor repairs	1 J.N.-4-D. (OX5)	500	15 min.	8,500	400	0	10.00			
B. B. & B. Aerial Co.	Marshfield, Wis.	Field (leased). 19 acres.	None	1 S.J.-1 (OX5)			12,000	400		.75 per min.			
Beaty Aviation Co.	Dallas, Texas	Field (leased). 50 acres; hangar 30x50.	Fair	1 J.N.-4-D (OX5) 1 Can. J.N. (OX5)	1,200	20 min.	12,000	800	0	5.00	.50	All points in Texas	.35
Nimmo Black Airport, Inc.	Chicago, Ill.	Field (leased). 40 acres; hangar 68x75.	Good	1 J.N.-4-C (OX5) 2 *Swallows* (OX5)	2,000	10 min.	18,000	3,500	0	10.00		St. Louis, Des Moines, So. Haven, Columbus, O., etc.	1.00-one way .60 round trip
Bowen & Huston	Windsor, Mo.	Field (leased). 35 acres; hangar	Ordinary	1 J.N. (W. 150 hp.)	150	20 min.	3,000	75	very little	10.00		Neighboring towns and Kansas City	
Vincent J. Burnelli	Amityville, N. Y.	Field (Curtiss); leased, at Copiague, L. I.	Complete factory at Amityville	R.B. Airliner, 30-pass. Biplane (L. 2400 hp.)	114	50 min.	8,000	550	0	Experimental			
Central Aircraft Co.	Holdrege, Nebr.	Field (leased). 40 acres; hangar, 32x60.	Have both	1 Can. J.N. (OX5) 1 *Lark* Monoplane (Law 60 hp.)	1,400	15 min.	24,500	432		10.00		Kearney, Minden, Oxford, Lincoln.	.50
Chadwick Bros.	150 Broad St., Newark, N. J.	Brainerd Field, Hartford, Conn., (owned by city), 90 acres.		1 S.J.-1 (OX5) 1 J.N.-4-D. (OX5)	1,100	20 min.	25,000	500		10.00			.75
C. E. Cheney Aero Co.	Greene, Iowa			2 J.N.-4-D. (OX5)	800	20 min.	16,000	750		7.50 & 10.00		North Central Iowa	20.00 per hr.
Cleveland Air Service	Coventry, Vt.	Field (owned). 800x1700; one-ship hangar.	Workshop in hangar: garage ½ mile	1 J.N.-4-D. (OX5) 1 S.J.-1 (C.-6)	125 Sept. 1st, 1921, to Oct. 21 1921	15 min. to 3½ hrs.	1,000	78	0	10.00		Burlington, Vt., Newport, Vt., Concord, N. H., Boston, Mass.	40.00 per hr. .60 per mile
Commercial Airship Syndicate	Kansas City, Kans.	Field (leased). 36 acres; hangar, 40x120.	General shops	*Pony Blimp* (gas capacity, 35,800 cu. ft.)	27	50 miles	1,200	21	350	10.00	.50		
Concord Aircraft Co.	Concord, N. H.	Field (State Mobilization). 1 mile long, ¼ mile wide; hangar, (4 barracks.)	State Highway Repair shop	1 S.J.-1 (W. 150 hp.) 1 S.J.-1 (OX5)	700	15 min.	22,000	1,000		10.00		All over New England	1.00 one way 1.50 round trip

Name of Company	Address	Air Port Facilities	Shop and Repair Facilities	Equipment	Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per Lb. of Freight	Operating Territory	Charge per Mile—Inter-city Flights
Cooke Aero Co.	Watertown, S. Dak.	Field (part owned and part leased). 40 acres, western edge of town. hangar, 50x54.	Shop	1 504-K (3-place, LeR.) 1 S.J.-1 (H.S.)						$10.00		Anywhere	$50.00 per hour (average)
Harry Depew Copland	Cambridge, Mass.	Seaplane Base (leased). Hartford, Conn. Indian Neck, Conn. Daytona Beach, Fla.		1 A.-39-B. (OXX6)	400	15 min.	6,000	500	200 (Maine to Florida)	10.00 to 25.00		Portland, Me., Boston, Springfield, Hartford, N. Y. C., Philadelphia, Washington, Richmond, Raleigh, Charleston, Savannah, Jacksonville, Daytona	.75
Robert H. Craig, Jr.	589 Arcade Bldg., St. Louis, Mo.	Field (municipal). Aerial Mail Hangar.		1 *Oriole* (K.-6)	200	10 min.	2,900	250		10.00		Anywhere — on demand	.50
Curtiss Aeroplane & Motor Corp.	Buffalo, N. Y. (Kenilworth Field)	Field (leased). 2000x800. 2 hangars.	Complete	1 S.J.-1 (C.-6) 1 J.N. (OX)	800	15 min.	15,000	200		10.00		Anywhere desired	.80 1 pas. 1.00 2 pas.
Curtiss Aeroplane & Motor Corp.	Garden City, N. Y.	Field(owned). ½ mile square. 14 hangars.	Complete	10-20 J.N.-1 (OX) 5 *Orioles* (C.-6) 2 *Orioles* (OX) 5 S.J.-1 (C.-6) 1 D.-Pusher 2 Navy Racers 1 C.T. 2 *Orencos*	3,000	15 min.	65,000	1,500		10.00		Anywhere desired	.80 1 pas. 1.00 2 pas.
Curtiss Aircraft Corp.	Dallas, Texas. (Love Field)	Field (leased by government). Regulation gov. flying school. 2 hangars.	Complete	Large stock of completed J.N.-4-D. and J.N.-4-C. (OX5)	50	30 min.	2,500	40	0			Local	
Curtiss Eastern Airplane Corp.	130 So. 15th St., Philadelphia, Pa.	Field (leased). 100 acres. 2 hangars, 50x75.	Complete	4 J.N.-4-D. 1 S.J.-1 (K.-6)	1,200	12 min.	60,000	829	0	10.00			.75
Curtiss-Indiana Co.	Kokomo, Ind.	Field (leased). ½ mile square. 3 hangars (1—48x100. 2—66x100)	Excellent	27 planes, including *Orioles*. (C.-6, K.-6, OX) S.J.-1, J.N.-4-D., Can. J.N. and Br. Bomber	10,000	15 min.	300,000	10,000	0	10.00 & 15.00	.50	Indianapolis, Chicago, Dayton and Rantoul	.50
Curtiss Iowa Aircraft Corp.	Fort Dodge, Iowa	Fields, 65 acres each: Ft. Dodge (owned), Des Moines (leased), Oelwein (leased), Fairfield (leased), Monmouth (leased), hangar for 6 planes at Ft. Dodge, for 2 planes at other fields.	Repair shop at each field	1 An. A-300-C, six-place (Fiat) 7 J.N.-4, (OX5) 2 S.J.-1, (OX5) 5 *Orioles* (K.-6)	6,000	15 min.	90,000	4,500		5.00 to 10.00	.15 cross country	Between own fields	.15
Curtiss-Metropolitan Airplane Co.	505 5th Ave., New York, N. Y.	Terminals: (Port Washington, L. I., N. Y. and Palm Beach, Fla.). for flying boats, one at each terminal.	Service at each	1 H.-16 Flying Boat (W.) 2 *Seagulls* 1 F. Boat 1 H. S.	1,000	10 min.	25,000	5,000		10.00		New York, Lake George, New London, Southampton, Newport, Atlantic City, Miami, Havana	.50
Curtiss Northwest Airplane Co.	707 Metropolitan Bank Bldg., Minneapolis, Minn.	Field (leased). ½ mile East and West, ¼ mile North and South. hangar, 65x70.	Fuselage and wing repair shop. motor repair shop. motor test stand	Large stock of completed *Orioles* (K.-6 and C.-6), S.J.-1 (K.-6 and OX), J.N.-4-D., Can. J.N.	1,500	15 min.	40,000	1,700	very little	10.00	.03½	Chicago, Twin Cities, Fargo, LaCrosse, Duluth, Sioux Falls, Aberdeen	.50

KEY TO AIRCRAFT AND ENGINE TYPES

A., A.-Navy, A.-Navy-H.S. and A.-39-B.; Aeromarine Plane & Motor Co., Keyport, N. J. An.; Ansaldo; Ansaldo Co., 65 Broadway, New York City. Balilla Racer; Ansaldo. B., and C.L.-4-S.; Boeing Airplane Company, Seattle, Wash. *Blue Bird*. Ashmusen Aeronautical Company, Omaha, Nebr. Br. Bomber; Breguet. Br. and Bullet Monoplane; Bristol. Camel; Sopwith. D. H.-6 and D.; DeHavilland. D. Special; Earl S. Daugherty, Long Beach, Calif. F.-3 Monoplane and C.-3 Biplane; Netherlands Aircraft Mfg. Co., Fokker, New York City. F.-40 and Sport F.; W. Wallace Kellett, representing H. and M. Farman. J.L.-6 and J.L.-12; J. L. Aircraft Corporation, New York City. J.N., Can. J.N., S.J., J.N.-4-D., J.N.-4-C., J.N.-4-H., D. Pusher, Navy Racers, C.T. Monoplane, C. Scout, *Orioles, Seagulls, F.Boats;* Curtiss Aeroplane & Motor Corp., Garden City, Long Island, N. Y. K.T. and O.W.; Dayton Wright Company, Dayton, Ohio. L.H., L.A.K.; Longren Aircraft Corp., Topeka, Kans. L.S.; Lincoln Standard; Nebraska Aircraft Corp., Lincoln, Nebr. L.W.F.; L.W.F. Engineering Company, College Point, New York. N.28; Nieuport. *Orenco;* Ordnance Engineering Corp., Baldwin, Long Island, N. Y. P. Special; Earl S. Daugherty, Long Beach, Calif. P.S., Pacific Standard; Pacific Aeroplane & Supply Co., Venice, Calif. R.B., Remington-Burnelli; Vincent J. Burnelli, Amityville, N. Y. Sp., Sport Plane; Lawrence Sperry Aircraft Corp., Farmingdale, Long Island, N. Y. St., Sturtevant; Sturtevant Aeroplane Company, Hyde Park District, Boston 36, Mass. S. V. A.; Ansaldo. *Swallow;* E. M. Laird Company, Wichita, Kansas. T.-M.; Thomas-Morse; Thomas-Morse Aircraft Corp., Ithaca, N. Y. U.E.; United Eastern. V.; Walter T. Varney, San Francisco, Calif. 504-K.; British Avros.

AIRSHIPS

Pony Blimp; Goodyear Tire & Rubber Company, Akron, Ohio.

ENGINES

An.; Anzani. Bd.; Beardmore. B.M.W.; J. L. Aircraft Corp., New York City. Bn.; Benz. Cl.; Clerget. Gn.; Gnome. H.-S., H.S.A5A.; Hall-Scott Motor Car Co., Berkeley, Calif. Law.; Lawrence Aero-Engine Corp., Farmingdale, Long Island, N. Y. Le.t.; LeRhone. L.-12; Liberty; Packard Motor Car Company, Detroit, Mich. and others. Mer. Mercedes. OX, OXX, OX5, OXX6, K.-6, C.-6, V2X; Curtiss Aeroplane & Motor Corp., Garden City, Long Island, N. Y. Sal.; Salmson. Stur.; Sturtevant Aeroplane Company, Hyde Park District, Boston 36, Mass. S.P.; Siddeley Puma. S.V.A.; Ansaldo. T.-M.; Thomas-Morse Aircraft Corp., Ithaca, N. Y. W.; Wright Aeronautical Corporation, Paterson, N. J.

(The above is based upon statements made to the Manufacturers Aircraft Association, Inc., and the Aeronautical Chamber of Commerce of America, Inc., in response to questionnaires sent to all known operators of aircraft. No opportunity has been available to determine the accuracy of the information and no responsibility is taken for the data except for the care with which the figures and facts are reported and the manner in which the summary is presented.)

Commercial Aircraft Operations in the United States, 1921 (Continued)

Name of Company	Address	Air Port Facilities	Shop and Repair Facilities	Equipment	Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per Lb. of Freight	Operating Territory	Charge per Mile—Inter-city Flights
Curtiss Wisconsin Aeroplane Co.	330 Clinton St., Milwaukee, Wis.	Field (leased). 100 acres. hangar, 50x50.	Good	1 S.V.A. single-seater (SPA, 220 hp.) 1 S.J.-1, three-seater (C.-6, 160 hp.) 1 Can. J.N. (OX5, 90 hp.) 1 S.J.-1, two-seater (OX5)	2,000	20 min.	40,000	500		$5.00			$.50
Earl S. Daugherty School of Aviation	Long Beach, Calif.	Field (owned); L shape, 1400x400 and 1350x270. 2 hangars. capacity, 11 ships.	Good	1 Can. J.N. (OX5) 2 J.N.-4-D. (OX5) 1 D. Special (OX5) 1 P Special (OX5) 1 N. 28 (Gn. 160 hp.)	1,978	15 min.	27,400	3,220	0	5.00& 10.00		Long Beach to Los Angeles, Venice, Ventura, San Diego, Pasadena, Riverside	50.00 per hour
Wm. R. Davis, Jr.	Oakland, Calif.	Terminal on property of Alaska Packers Assn., Alameda. hangar, 76x35.	Tools and accessories	1 L.H.-4-H. Seaplane (H.S. A.-5-A. Touring, 175 hp.) (OXX3, 110 hp.)	62	30 min.	2,000	20	0	10.00		Oakland, San Francisco, Berkeley, Alameda, Sausalito, Richmond, etc.	
Dayton Wright Co.	Dayton Ohio	Field (leased). 151 acres. hangar space in main plant.		1 K.T. (L.-12) 1 O.W. (W. 150 hp.) 1 S.J.-1 (H.S.L.-6)	800	30 min.	32,450	963				Detroit, Cleveland, Indianapolis, Toledo. (occasionally N. Y. city)	
DeLuxe Air Service, Inc.	Asbury Park, N. J.	Fields: Deal, N. J. (800x1800) and Como, N. J. (1800x1500). hangar at Deal, 160x35. ten at Como.	At Deal	4 Can. J.N. (OXX & OXX5) 1 J.N. (twin OXX)	400	10 min.	6,000	400	200	10.00		New York, Atlantic City	.50
The Ralph C. Diggins Co.	140 No. Dearborn St., Chicago, Ill.	Field (leased). 1 square mile. 3 hangars, 65x40x15.	Excellent	4 Can. J.N.-4 (OX5) 1 504-K, three-place, (LeR. 110 hp.) 1 S.V.A.-9 (SPA, 220 hp.) 1 D.H.-9 (S.P., 240 hp.)	10,000	4-5 min.	60,000	2,000	very little	10.00		Chicago and all Middle Western cities	.25
Edgewater Beach Air Service	3158 No. Clark St., Chicago, Ill.	Terminal: Edgewater Beach Hotel (leased). hangar, 54x30.	Machine shop and mechanic	1 *Seagull* (C.-6, 160 hp.)	250	20 min.	50,000	300	newspapers	15.00–1 25.00–2		Chicago-Evanston. Milwaukee, Waukegan, Benton Harbor and all points on lake	1.00
G. Elias & Bro., Inc.	Buffalo, N. Y.	Terminal foot of Jersey St., 50x200. 2 hangars, 40x50.	Complete		25 (test)	30 min.	3,000	0	0				
F. W. Farris	Stockton, Calif.	Field: Stockton Aviation Center (leased). 64 acres. hangar, 50x35.	Repair facilities	1 J.N.-4 (OX5)	753	10-15 min.	15,000	430	0	10.00 up		Stockton, Fresno, Modesto, San Francisco, Sacramento—any town in San Joaquim Valley	.75
Finger Lakes Air Service. Inc.	Auburn, N. Y.	Terminal: Owasco Lake, Auburn, N. Y.		1 A.-Navy H.S.-2-L. (6-pass.)	150	15 min.	4,500	450	0	10.00		Owasco, Skaneateles, Cayuga and Seneca Lakes, and Thousand Islands	
Flying U School of Aviation	San Antonio, Texas	Field (leased). speedway 2000 acres. Stenson Field, 1000 acres. 4 hangars, 40x150 and 30x70.	Machine shop and assembling plant	7 J.N.-4-D. 1 S.J.-1 1 T.M. 1 *Camel* (OX5, H.S., Cl., LeR., L. 12)	400	25 min.	12,000	150	1,000	10.00		Corpus Christi, Dallas, and San Antonio	.50
Oliver Gies Airplane Co.	Great Falls, Mont.	Field (leased). ¼x½ mile. hangar, 40x55.		1 S.J.-1 (OXX6)	100	20 min.	3,000	60		10.00		Great Falls, Helena, Montana	50.00 per flying hour
Good & Foster Aerial Service	Love Field, Dallas, Texas	Love Field (leased). Government. Hangar.	General airplane repair	2 J.N.-4-C. (OX5)	150	Varied	4,000	50	100		.75	Dallas, Tulsa, Ardmore, Oklahoma City and Breckenridge, Texas	.75
Grand Island Aero Co.	Grand Island, Nebr.	Field (leased). 2700x500. 3 hangars (2—Tent. 1—40x90.)	Repairing at field	4 J.-N.4-D. 2 *Orioles*		10-15 min.	20,000	500		7.50 to 15.00			.50
Great Lakes Airways Co., Inc.	Cleveland, Ohio	Terminals: Put-In-Bay, Cleveland, and Detroit. inside harbor at Cleveland (permission of city). 6 miles by 1 mile. hangar for one ship at Put-In-Bay.	Excellent for boat repair. fair for motors	1 A.-H.S.-2-L Cabin Cruiser (L. 330 hp.)	100	20 min.	1,200	100	200	10.00 to 15.00	.30	Cleveland, Detroit, Put-In-Bay, Erie, Sandusky, Toledo	.50 to .75
Gulf States Aircraft Co.	Shreveport, La.	Uses Fair Grounds.		2 S.J.-1, 3 pass. (OX5)	1,000	10 min.	25,000	1,000		5.00 to 10.00		Southern States	.25 each way

Name of Company	Address	Air Port Facilities	Shop and Repair Facilities	Equipment	Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per Lb. of Freight	Operating Territory	Charge per Mile—Inter-city Flights
Dillard Hamilton	West End Viaduct, Dallas, Texas.	Field (leased), 108 acres	5 mechanics, 1 pilot. Good repair shop	1 Can. J.N. (OX5)		2 hrs.	3,500	Few		$5.00	$1.00 per mile	Texas	$1.00
A. W. Hansen	Rio Vista, Calif.			1 L.S. (W.)									
Heddon Aviation Co., Inc.	Dowagiac, Mich.	Field (leased). 40 acres. hangar, 44x56.	Good	2 Can. J.N.-4-C. (OX5) 1 *Swallow* 1 S.J.-1 (OX5)	1,069	Varied (cross country)	22,000	1,013	500	10.00 up	By contract	Northern Indiana, Southern Michigan	.75 to 1.00
Henderson-Mauldin Aero Service Co.	Fulton, Mo.	Field (leased). 2000x2600. hangar, 60x90.	Good	2 J.N.-4-D. (OX5)	1,500	20 min.	30,000	700	0	5.00		Missouri, Kansas, Illinois, Texas and Oklahoma	.50
William Hill Airplane Co.	Arkansas City, Kans.	Field (leased). 90 acres, 1 mile north of city.	Oil and gas on field. Hill Garage city	1 J.N.-4-D. 1 S.J.-1	2,000	10 min. to 2 hrs.	40,000	1,500		7.50–1 15.00–2		Kansas, Oklahoma, Texas	.50
Hodgen Aerial Service	Enid, Okla.	Hangar for 2 ships.		2 S.J.-1 (OX5)	1,000	15 min.	17,000	800		7.50		Enid, Oklahoma City	.50
Cliff Hogan Aviation, Auto and Tractor School	2623 McGee Trafficway, Kansas City, Mo.		Repair shop	1 Can. J.N. (3 engines)	Few								
E. Hubbard	56 Roanoke St., Seattle, Wash.	Terminals (leased): Seattle, Wash. and Victoria, B. C. Lake Union, Seattle, 2x¾ mile. Victoria Harbor, ¾x¼ mile. hangar, 220x100.	Repair service from Boeing Airplane Co., Seattle, Wash.	1 B.-1 Flying Boat 1 C.L.-4-S. Seaplane	200	2 hrs.	20,000	100	50,000 U.S. Mail	10.00	. 0½	Seattle, Wash., and Victoria, B. C.	
Fred W. Hungate	Pomeroy, Wash.	Field (owned). Government hangar.		1 J.N.-4	20	15 min.	900	20		10.00		Pomeroy and Spokane, Wash.	.50 one way, .75 two ways
Huron Aerial Rapid Transit Co.	Huron, So. Dak.	Field (leased), hangar.	Shop	1 J.N.-4 (OX5)		10-12 min.	20,000	500	0	10.00		So. Dakota, parts of Nebraska, Minnesota, N. D.	.33⅓ minimum 25.00
Johnson Airplane & Supply Co.	Dayton, Ohio	Field (leased), 1500x2200, hangar, 120x80.	6 buildings. supply station for aircraft material and all leading accessories	1 J.N.-4-D. (OX) 1 J.N.-4-H. (W.) 1 F.E.-2-B. (Bd. 160 hp.) 1 L.V.G. (Bn. 220 hp.) 1 Can. J.N. (OX5)	500 Started May 1, 1921	30 min.	20,000	100	3,000	10.00		Dayton, Columbus, Cincinnati, Kokomo, Piqua, all parts of Ohio, Indiana and W. Va.	1.00
W. Wallace Kellett	717 Widener Bldg., Philadelphia, Pa.	Field (leased), hangar.		F-40 Pushers 3 Sport F., 2 seaters	300 (demonstration)	20 min.	7,500	150	0				
Kelso Aviation Co.	Lewiston, Idaho	Field (leased), 600x1800, hangar, 50x60.		1 J.N.-4 (OX5) 1 S.J.N.-1 (OX5) 1 L.S. (W. 150 hp.)	5,000	15 min.	60,000	3,000	0	5.00		All cities in North West	40.00 per hour
Killapa Harbor Aero Mfg. Co.	Hoquiam, Wash.			Small seaplane (own manufacture (LeR. 80 hp.)	Test flight	20 min.	15						
C. G. Killingsworth	116 W. 9th St., Dallas, Texas	Field: Viaduct Aviation Field (leased). 200 acres.	Garage	1 J.N.-4-C.	100	15 min.	1,500	100		5.00		Waco, Mexia, Ft. Worth, Breckenridge	.75
E. M. Laird Co.	Wichita, Kans.	Field (owned). N. E. of town. 1300 ft. sq., 4 hangars, 40x50.	Factory building, 66x140	*Swallows* (OX5)	2,500	30 min.	100,000	2,000		10.00		Wichita, Chicago, Kansas City, Tulsa, Omaha, Denver, etc., anywhere	
Lambert Flyers	Ellenboro, W. Va.	Fields at Lamberton, W. Va. and El Dorado, Ark., 40 acres sq.. hangars, 90x100, 40x100 respectively.	Good	6 S.J.-1 (K.6 and C.-6) 1 *Oriole*	300	varied—up to 1 hour	20,000	500		5.00 up		All over U. S. A.	
John M. Larsen	347 Madison Ave., New York City	Field: Central Park, L. I., N. Y. 1000x2600, 3 hangars, 10,000 sq. ft. area.	Complete manufacturing facilities	6-8 J.L.-6 All Metal Monoplanes (BMW, 185 hp.) 1 J.L.-12 (L.)	1,500	varied—up to 26 hours 19 min.	100,000	8,000		demonstration		Many trips N. Y.-MiddleWest. N. Y.-Chicago. N. Y.-Omaha. Transcontinental—N. Y.-San Francisco. Mexico City to Arctic Circle, etc.	
L. W. Leib	Volga, S. Dak.	Field (leased), 720x1000, hangar.	Good	1 S.J.-1 (OX5)	800	10 min.	8,000	460	0	5.00			.50
James Levy Aircraft Co.	Indiana Ave. at 21st St., Chicago, Ill.	Field: Aero Club of Illinois.		Can. J.N.'s 504-K.'s, 3-seater	40 (sales demonstration)	15-20 min.	700	30					

For abbreviations see page 1167.

Commercial Aircraft Operations in the United States, 1921 (Continued)

Name of Company	Address	Air Port Facilities	Shop and Repair Facilities	Equipment	Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs of Freight	Charge per Short Flight	Charge per Lb. of Freight	Operating Territory	Charge per mile—Inter-city Flights
Lexington Aviation Co., Inc.	Lexington, Ky.	Field (leased). 900x2100.	In town	1 504-K., 3-seater	50	30 min.	1,200	40		$ 15.00-2		Central Kentucky	$.50
Lirette's Flying Circus	Dallas, Texas.			1 J.N.-4	300	30 min.	12,000	200	0	5.00 & 10.00		Texas, Oklahoma and Louisiana	.75
Floyd J. Logan Aviation Co.	Cleveland, Ohio	Field (leased). 70 acres. hangar.	Good	2 Can. J.N. (OX5) 1 S.J.-1 (OX5)	500	7 min.	5,000	442		5.00 to 10.00			.60
Longren Aircraft Corp.	Topeka, Kans.	Field (leased). ½x¾ mile, adjacent to factory. hangar.	Complete factory	1 L.H. (OX5) 1 L.A.K. (Law. 3 cyl.) 3 L.A.K. (An. 6 cyl.)	demonstration	varied—10 trips of 300 miles	30,000	500	0	10.00		Anywhere	
Lowell Aircraft Co., Inc.	Oberlin, Ohio	Field (leased). 200x900. hangar, 45x50.	Very good for motor accessory	1 J.N.-4-D. (OX5) 1 S.J.-1 (OX5) 1 Can. J.N. (OX5)	50	30 min.	2,500	15		10.00		Oberlin and Cleveland, Ohio	1.00
Lutz Manor Co.	Oshkosh, Wis.	Field (leased). at city limits. 80 acres, rectangular, good approach. hangar, 45x65, for 3 planes.	Good	1 J.N.-4-D. (OX5 and OXX6) 1 Balilla Racer A.-1 (SPA, 225 hp.)	1,000 (100 averaging 1½ hrs.	10 min.	20,000	500	0	5.00 to 10.00			35.00 per hour
Lynchburg Air Service Corp.	Lynchburg, Va.	Field (leased).	Shop, warehouse, 2 mechanics	1 S.J.-1	75	1-2 hrs.		0					
LynnwayAerialTransportationCo.	Lynn, Mass.	Field (leased). 1000x1500. 2 individual hangars.	Good	2 Can. J.N. (OX5) 2 S.J.-1 (OX5) 1 Can. J.N. (OXX6) 1 S.J.-1 (C.-6) 1 S.J.-1 (Mer. 160 hp.)	1,800	15 min.	27,000	2,000	10,000	10.00		Providence, R. I., Lawrence, Mass. etc.	.50
McGraw Aviation Co.	116 W. 9th St., Dallas, Texas.	Field (leased). 108 acres.	Shop 40x30 and shed	3 J.N.-4-D. 9 J.N.-4-C. 1 S.J.-1 (W. 180 hp.) 1 S.J.-1 (W. 150 hp.)		10 min.	14,600	1,460		5.00		All points	1.00
R. W. Mackie	Houston, Texas	Field (small), hangar (rented).	Repairs handled	1 S.J.-1 (OX5)		15 min.	35,000	800	0	10.00 to 15.00		Houston and surrounding country	.40
Massachusetts Aircraft Corp.	Delano Ave., Point of Pines, Mass.	Field: Saugus Race Track (1 mile track). hangar, for 3 ships.	Motor room	1 Bullet Monoplane (LeR. 120 hp.) 1 504-K (LeR. 12 hp.) 1 Can. J.N. (OX5)			3,000	150	0	10.00			
Mattley Aviation Co.	Richmond and San Francisco, Calif.	Fields (public). second class, temporary.	Temporary	1 Can. J.N. (OX5) 1 L.S. (W. 150 hp.)	400	20 min.	8,500	450	100	10.00	Vary	Northern Calif.	.50 to .75
Maxim Air Service Co.	Waterville, Me.	Field (leased). 2400x550.	Repair shop, spare parts	2 Can. J.N. (OX5) 1 S.J.-1 (OX5)	700	15 min.	10,000	600	0	10.00		Central Maine	.75
Mayer Aircraft Corp., Inc.	Bridgeville, Pa.	Fields (owned). No. 1, 30 acres. No. 2, 65 acres. hangar, 50x120.		1 *Oriole* (C.-6) 1 S.J.-1 (Mer.) 1 S.J.-1 (OX5) 1 *Swallow* (OX5)	600	20 min.	12,000		0	10.00		Pittsburgh and vicinity. East to Philadelphia. West to Columbus, and North to Buffalo	1.00
Michigan Aero Service Corp.	Lansing, Mich.	Fields (leased) Lansing, Battle Creek, Jackson, Detroit, 40 acres.	Factory at Lansing	1 J.N.-4-D. (OX5) 3 S.J.-1 (OX5) 1 S.J.-1 (OXX6) 1 S.J.-1 (W. 220)	2,000	15 min.	30,000	1,200	175	10.00	.005	Battle Creek, Lansing, Jackson. all Michigan	.50
Mobridge Aerial Co., Inc.	Mobridge, S. Dak.	Field (leased). 200 acres. hangar for 2 ships.	Good	1 Can. J.N. (OX5) 1 L.S. (W. 150 hp.) (W. 220 hp. extra)	200	10 min.	2,000	100	0	10.00			
Netherlands Aircraft Mfg. Co. (Fokker)	286 5th Ave., New York, N. Y.	Field (uses Curtiss Field, Mineola, L. I., N. Y.). 1½ hangars rented, 60x80.	Own personnel for repairs and overhauling	2 F-3 Monoplanes (BMW, 185 hp.) 1 C.-2 Biplane (BMW, 185 hp.)	215 From July 21, 1921	31 min.	10,000	812		demonstration		N. Y.-Philadelphia, N. Y.-Washington, Philadelphia-Washington, N. Y.-Hartford, N. Y.-Providence	
R. A. Northrup	Great Bend, Kans.	Field (leased). 622x1000. hangar, 48x34.	Good	1 Can. J.N (OX5)	100	15 min.	7,500	100	0	7.50		Gt. Bend to Hutchinson, Wichita, La-Crosse, Kansas City	.50

Name of Company	Address	Air Port Facilities	Shop and Repair Facilities	Equipment	Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per Lb. of Freight	Operating Territory	Charge per Mile—Inter-city Flights
Nevada Aviation Corp.	Reno, Nevada	Fields: Reno (Air Mail). Beowa, Nev. and Fallon, Nev., (private) and Yerington, Nev. (city). hangar, 30x40 at Yerington.	Shop at Reno, Nev.	2 J.N.-4-H. (W. Model A, 150 hp.)	500	15 min. up (cross country)	4,000	400	0	$15.00		Nevada	$1.00
Newport News Aero Club	Newport News, Va.	Field (leased) 40 acres hangar, for 4 planes.	Complete	1 J.N.-4-D. (OXX6) 2 Can. J.N. (OX5)	1,200	20 min.	24,000	500	Very little	10.00			.50 to 1.00
New York Aircraft Exhibition Corp.	Troy, N. Y.	Field (leased). small.	Good	1 Can. J.N. (OX5)	3,500	12-15 min.		120		10.00		Troy, Albany and vicinity	
Oakley & Askew Aerial Service	Ardmore, Okla.	Field (leased). 40 acres, 1 mile No. of Ardmore. hangar, 60x90.	Engine and wing work	2 Can. J.N.-4 (OX5) 1 L.S. Model E (W. 180 hp.) 1 S.J.-1 (H.S.L.-6, 220 hp.)	800	30 min.	27,000	1,000	0	5.00		Ardmore, Oklahoma City, Dallas, Ft. Worth, Texarkana, Wichita Falls, etc.	20.00 per hour
Oberlin Aircraft Co.	Oberlin, Ohio	Field (owned). 2 hangars, 80x100.	Good	2 Can. J.N. (OX5) 1 S.J.-1 (Bn.) 1 J.N.-4 (OX5)	800	3 hrs.	5,000	400		10.00 & 20.00		North to South	
Oregon-Washington & Idaho Airplane Co.	Portland, Ore.	Field (leased). circular, 1300x 700. 6 hangars, 1 water hangar (4 ships). office building.	Large shop, wood work and motor overhaul and testing bldg.	3 *Seagulls* (K.-6 and C.-6) 2 F. Boats (OXX) 3 J.N.-4-D. (OX5) 4 S.J.-1 (OX5) 2 Can. J.N. (OX5) 3 *Orioles* (K.-6) (4 spare OX5 and 1 K.-6)	2,000	30 min.	80,000	1,500	26,000 lbs. papers	10.00		Portland, Astoria, Seaside (daily), St. Helena, Rainier, Oregon City, Salem, Corvallis, Eugene, The Dalles, Pendleton, La Grande, Tacoma	Based on character of country
Parker Aircraft Co.	Perry, Iowa.	Field (leased). ground and basement. hangar, 45x50.	30x60	1 Can. J.N. (OX5) 1 J.N.-4-D. (OX5) 1 D.H.-6 (OX5)	263	16½ min.	3,450	247		5.00 to 10.00		Anywhere	.15
Sidney E. Parker	Lake Placid, N. Y., and Montreal, Can.	Dock at Lake Placid.		1 *Seagull* (K.-6) 1 504-K (LeR. 110 hp.) 3 504-K (Cl. 180 hp.)	1,500	25 min.	40,000	900		10.00		N.Y.-Montreal, Lake Placid, Burlington, Vt.. lake to lake in Adirondacks	.50
Penn Aero Corp.	Huntingdon, Pa. and Lancaster, Pa.	Field (leased). 1500x2000. hangar, 75x100.	Small repair shop	1 S.J.-1 (OX5) 1 J.N.-4-D. (OX5)	800	12 min.	10,000	700	500	10.00		Huntington to Lancaster	.50
Harold G. Peterson Aircraft Co., Inc.	White Bear Lake, Minn.	Field (leased). 30 acres. hangar, 66x66.	Shop, 50x16	1 Can. J.N. (OX5) 2 L.W.F. (C2X) 1 Sop., 3-seater (Cl. 130 hp.) 1 N., 2-seater (LeR. 80 hp.) 1 Scout, (Gn. 50 hp.)	600	30 min.	21,000	500	0	7.50			.50-1 .35-2
T. C. Peterson	Santa Ana, Calif.	Field (leased). 400x1200.	Temporary	1 P.S., 3-place, (OX5)	600	20 min.	12,000	1,000		5.00		San Diego, Los Angeles, San Francisco and intermediate cities	.50
Pioneer Aero Co., Inc.	41 Willow Ave., Plainfield, N. J.	Field (owned). 856x300. hangar, 42x42.		1 D.H.-6 (OX5)	100	1 hr.	7,500	50				Plainfield, Atlantic City and Hasbrouck Heights	
Robertson Aircraft Corp., Inc.	5248 Oakland Ave., St. Louis, Mo.	Fields (municipal). 60 acre Flying Club of St. Louis, 183 acres. 2 hangars, for 3 ships each.	Good. opposite municipal landing field	3 J.N.-4-D. (OX5) 2 J.N.-4-C. (OX5) 1 *Oriole* (K.-6) 1 St. (St. 140 hp.)	5,000	10 min.	35,000	1,000	3,000	.50 to 1.00	.35	St. Louis to Chicago, St. Louis to Kansas City, St. Louis to Memphis, St. Louis to Indianapolis	.50-1 .30-2
Rogers Aircraft, Inc.	Venice, Calif.	Field: Rogers Airport, Los Angeles (leased). 73 acres. 7 hangars, housing 22 planes.	Factory, 10,000 sq. ft.. complete repair facilities	4 P.S. (OX5) 1 P.S. (C.-1) 2 N. 28 (Gn. 160 hp.)	7,240	14 min.	101,360	10,860	0	5.00		Los Angeles and San Diego-San Francisco	.30
Roseswift Airplane Co., Inc.	Grand Rapids, Mich.	Field, 2700x2000. hangar, 50x100.	Work shop for repairing motors	3 S.J.-1 (OX5 and OXX6)	250	15 min.	6,000	150	0	10.00		Charlevoix, Ionia, Muskegon	.50
Basil L. Rowe	Sidney, N. Y.	Field (leased). 2000x500.		1 D.H.-6 (OXX6)	350	10 min.	5,000	500	0	10.00			
Runser & Turner	Columbia, So. Car.			1 504-K, 3-place (LeR.)			25,000	500	0	10.00 to 20.00		Throughout Southeastern States	.50
Foster Russell Aviation Co., Inc.	Spokane, Wash.	Field (leased). 800x2500. 1 hangar for 4 planes, 1 tent hangar for 1 plane.	Good	1 J.N.-4-D. (OX5) 1 S.J.-1 (OX5) 1 S.J.-1 (K.-6)	3,075	10 min.	32,500	2,575	0	5.00 & 10.00		100 towns in Eastern Washington and Northern Idaho	.50
R. W. Schroeder	2276 Logan Blvd., Chicago, Ill.			1 S.J.-1 (OX5) 1 *Swallow*	18	1 hr.	1,500	10					

For abbreviations see page 1167.

Commercial Aircraft Operations in the United States, 1921 (Continued)

Name of Company	Address	Air Port Facilities	Shop and Repair Facilities	Equipment	Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per Lb. of Freight	Operating Territory	Charge per Mile—Inter-city Flights
Seattle & Puget Sound Airway Co.	1519 3rd Ave., Seattle, Wash.	Terminal: Lake Washington, hangar.		1 *Seagull* (C.-6)	310	15 min.	5,800	620		$5.00			
Security Skycraft Co.	Aberdeen, So. Dak., Fargo, N. Dak.	Field (municipal), at Aberdeen, 100 acres.		2 S.J.-1 (H.S.) 1 S.J.-1 (OX5) 1 Can J.N.	1,000	30 min.	6,000	980		10.00-2		Fargo, N. D., and Aberdeen, S.D.	.50-2 .40-1
Seery Aviation Co.	Sault Ste Marie, Mich.	Field (leased). 60 acres.		1 Can. J.N. (OX5)	50	10 min.	1,500	40	0	10.00		Northern Michigan	1.00 or .60 round trip
Sheldon Air Line	Sheldon, Ill.	Field (owned). 1320x660, perfect approach.	Machine shop, spares etc.	4 J.N-4-C.(remodeled)(OX5)	700	15 min.	18,750	300	2,000	5.00			
Mac Short	Salina, Kans.	Field (leased). 40 acres.	Motor and plane overhauling	1 Can. J.N.-4-D. (OX5)	100 hrs.	2 hrs.	1,600	50	100	7.50	.75	Manhattan, Kans., Kansas City, Omaha, Lincoln, Wichita, etc.	.75 one way .50 round trip
Sierra Aircraft Co.	Pasadena, Calif.	Field (leased). Foothill Blvd., 3 miles E. center Pasadena, 65 acres. 3 hangars, 50-ft. doorways.	Good	1 S.J.-1 (K.-6) 1 J.N.-4-D. (OX5) 1 S.J.-1 (OXX6)	1,500	15 min.	30,000	1,200	0	5.00		Pasadena, San Diego, San Francisco, Fresno, etc.	.35 up
(Miss) Neta Snook Aircraft Co.	Huntington Park, Calif.	Field (Goodyear) (leased). 300 acres, hangar, 40x150.		1 Can. J.N. (OX5)	1,000	7 min.	6,000	183		5.00		Los Angeles, Venice, Beverly Hills, San Bernardino, Riverside, Alhambra	.50
Southern Aircraft Co.	Houston, Texas	Field (leased). 20 acres, adjoining field 150 acres, hangar for 8 planes.	Fair	4 Can. J.N. (OX5) 1 S.J.-1 (OX5)	1,000	30-45min.	20,000	1,200	Verylittle	7.50		All Texas and some Louisiana cities	.50
Southwest Airplane Co., Inc.	Tulsa, Okla.	Field (owned). 120 acres. 2 nangars (steel), 90x65.	Motor and wing and fuselage shop	1 S.J.-1 (K.-6) 1 Br. 3 J.N.-4-D. 1 C. Scout 1 *Oriole* (K.-6) 1 Can. J.N.	1,100	10 min. to 3 hrs.	25,000	1,500	1,000	15.00-2	Vary	Entire Southwest. Kansas City, Dallas, Houston, Oklahoma City, etc.	.50
Lawrence Sperry Aircraft Co.	Farmingdale, L. I., N. Y.	Field(leased).1800x2400, nangar (leased) at Curtiss Field.	Complete for manufacture and repair	1 Sp. Sport (Law. 60 hp.) Many 504-K (LeR. 110 hp.) (Detachable High Lift Wing)	612	25 min.	12,600	500	0			Farmingdale to Garden City, Washington, D. C. and Hampton Roads, Va.	
Standard Airplane Co.	Dallas, Texas	Field (leased). 100 acres.		J.N.-4-D.'s (OX5) J.N.-4-C.'s (OX5) S.J.-1 (W.)	600	25 min.	16,000	900		5.00 & 10.00			.50
Marion Sterling	Waco, Texas	Field 25 acres, hangar.	Private	1 S.J.-1 (OXX6)	200	10 min. to 2 hrs.	7,500	100	Very little	5.00		Mexia, Dallas, Austin, etc.	.50
St. Louis Curtiss Airplane Co.	St. Louis, Mo.	Field (municipal). 1000x1500.	Limited	1 J.N.-4-C.	1,000	15 min.	15,000	1,000	0	5.00 & 10.00	.00¼	Within 1000 mile radius	.50 one way .30 round trip
St. Petersburg Air Boat Line	St. Petersburg, Fla.	Terminal (owned). 50x40.	Good	1 C.F. Boat (two W.) 2 J.N. (OX)	500	10-15 min.	7,500	450		15.00		Tampa, St. Petersburg, Key West, Havana and Coastwise	1.00 per min
Strubler Aero Co.	Colorado Springs, Colo.	Field (leased). 270 acres, hangar for 2 planes.	Very little	1 *Oriole* (C.-6) 1 A. (T.M.)	150	15 min.	2,000	300	0	10.00		Denver, Colorado Springs, Pueblo	.75 to 1.00 per min.
Tennant Bros.	Sioux Falls, So. Dak.	Field (leased). 40 acres, hangar, 30x50.	Private	1 J.N.-4-D. (OX5) 1 Can. J.N. (OX5)	1,600	10 min. to 1 hr.	20,000	1,500		5.00 & 10.00		Throughout So. Dakota, Western Minnesota and Iowa.	.60 min. 45.00 hr.
United States Aircraft Corp.	1803 3rd Ave., Spokane, Wash.	Field (municipal). 1000 acres, hangar, 100x50.	Machine shop, welding, all facilities	2 S.J.-1 (H.S.L.-4) 1 S.J.-1 (H.S.L.-6) (2 L. 12 hp.) (2 LeR.) (4 H.S. 97-A) (2 H.S.-A5A.)	500	40 min.	20,000	350	500	5.00 & 10.00		Spokane, Lewiston, Seattle, Kalispel, Eureka, Helena, Gt. Falls, Missoula, Wenatchee, Colfax	.30
Walter T. Varney	832 Post St., San Francisco, Calif.	Field (leased). San Carlo, 2000x6000, hangar for 15 planes.	Excellent. shop, 30x300	1 Br. 3 V. (W. 220 hp.) 8 V. (W. 150 hp.) 1 J.N.-4-D. School ship	6,000	10 min.	200,000	1,000		10.00		Los Angeles, Yosemite, Portland, Reno, etc.	.50 to 1.00
William Westlake	1446 Chase Ave., Chicago, Ill.	Field (leased). 50 acres, tent hangar.		1 J.N.-4-D. (OX5)	500	10-15 min.	7,500	500	0	10.00		Chicago, Evanston, Milwaukee	.60

Name of Company	Address	Air Port Facilities	Shop and Repair Facilities	Equipment	Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per Lb. of Freight	Operating Territory	Charge per Mile—Inter-city Flights
White's Aircraft	Des Moines, Iowa.	Field (leased), 80 acres. 2 hangars (portable.)	Complete repair shop	1 Can. J.N. (OX5) 3 J.N.-4-D. (OX5) 1 Sport Monoplane (own manufacture) (25 hp.) 1 Special Monoplane (St. 5A.)	215	10 min.	5,000	153		5.00 & 10.00		Anywhere. cross-country.	.25
Whitted Air Line	St. Petersburg, Fla.	Terminal (leased). 50x100. hangar (owned), 50x100.	Good	1 C.F. Boat 1 A.39-A. (W. 150 hp.) (two OXX6)	1,100	12 min.	13,000	1,250		10.00 & 15.00		Tampa, Clearwater, Pensacola	1.00 less 10%
Wittemann Aircraft Corp.	Hasbrouck Heights, N. J.	Field, 5000x8000. 800 acres. hangar.	Complete factory and assembly floor	5 D.H.-6 (OX5)	500	20 min. to 3 hrs.	7,500	200	0	Demonstration		Hasbrouck Heights and Washington. Hasbrouck Heights and Mineola	
Wood & Gallatin	2020 Main St., Buffalo N. Y.			1 S.J.-1 (OX.) 1 S.J.-1 (W. 150 hp.)	1,500	20 min.	50,000	1,600		10.00 & 15.00		Eastern States between N. Y. and Florida	.80-2 1.00-1
C. B. Wrightsman	Tulsa, Okla.	Field (Curtiss). Southwest Airplane Co.)		2 S.V.A.-9 1 S.J.-1 (OXX)		30 min.	25,000	50	0				
		Total terminals, 146, including 116 land, 30 sea, of which 16 were public.		Between 500-600	130,736	21	2,907,245	122,512	123,227	$9.00			

For abbreviations see page 1167.

London-Paris Air Services Compared

THE first year of subsidized British air services, ending in March, 1922, forwarded to the Department of Commerce by Commercial Attache Tower, shows the following results for the London-Paris route, where two companies, Handley Transport, Ltd., and Instone Air Line, Ltd., have maintained daily services, weather permitting.

BRITISH AIR SERVICES

	London to Paris	*Paris to London*	*Total*
Number of machines.	526	524	1,050
Number of passengers	2,989	2,709	5,694

The French competitors of these two services, on the London-Paris route, made more flights, but carried fewer passengers, the comparative figures being as follows:

FRENCH AIR SERVICES

	London to Paris	*Paris to London*	*Total*
Number of machines.	775	787	1,562
Number of passengers	2,043	2,380	4,423

The British companies carried sixteen tons of goods, and the French fifty-three tons between Aug. 1, 1921, and the end of February this year.

MESSRS. VICKERS and the Shell oil group have submitted a scheme to the British Government for using five of the lighter-than-air airships for a weekly passenger service to India and Australia, according to information forwarded to the Department of Commerce. The scheme is the outcome of investigations by Commander C. Dennis Burney, inventor of the paravane. A new carbureter which uses gasoline or oil combined with hydrogen is a factor that adds strength to the feasibility of the scheme, as this will allow the load of the ship to be increased 40 per cent.

A company is proposed with a capital of £4,000,000, of which £3,400,000 is to be used for the purchase of new airships. The Government is asked to give a subsidy to be divided between the three countries involved. The journey to Bombay will be reduced to 5½ days and to Australia to 11½ days, while the proposed fares would be £85 to India and £130 to Australia (£30 less than first class mail steamship accommodations).

Commercial Aviation in Hawaii

THE "Star-Bulletin" of Honolulu is favorably impressed with the possibilities for the successful operation of commercial aerial transportation in Hawaii, stating that the conditions, climatic and geographical, are ideal in this group of islands for an all-the-year airplane service. Storms of great severity are extremely rare, and each island offers its haven of peaceful, protected ocean water for seaplanes, which, of course, are the types of flying machines best adapted for inter-island service. It believes that the transportation of the mails, express and passengers should give to a commercial airplane service sufficient business to make the venture profitable and, if not at the outset, at least as soon as a period of successful operation convinced people of its practicability. Army and Navy airmen who have made many inter-island flights are virtually unanimous in the opinion that a commercial service is feasible.

MOTOR buses are being used by thirty-two electric railways in the eastern part of the United States, and motor buses with flanged wheels are being used by twenty-eight short line steam railroads.

Trend Toward Light Car in Belgium Aid to American Manufacturers

American cars stand second only to French in Belgian imports for 1921. Possibilities for installation of bus lines. Exceptionally strong construction necessary for trucks and buses. Use of the tractor is in its infancy.

BELGIUM was one of the pioneer nations in the automobile industry due to the activity and initiative of such concerns as the Fabrique Nationale des Armes de Guerre (better known in this country as "F.N."), Minerva, Pipe Metallurgique, etc.

The automobile manufacturers of Belgium are mainly devoted to supplying the demand of the domestic market. Their exports in 1919 were not phenomenal while in 1920 they amounted to 1199 automobiles, 539 chassis and 1707 motorcycles.

Some of the older concerns have dropped out of the ranks of keenest competition since the war, but there have been many new ones established in 1919 and 1920 to take their places. These concerns have done a moderate amount of business in spite of very strenuous foreign competition. Statistics show the following number of cars imported and exported in 1920 and 1921:

	Imports	Exports
1920	4460	1848
1921	4815	1141

The number of imports in 1921 and the countries supplying them in the order of their importance were: France (2223 cars), United States (846), Germany (824), Italy (661) and Great Britain far behind with only 57, although she absorbed the largest proportion of Belgian exports. Thus we see the United States slightly in the lead of Germany, but trailing France. Belgium has attempted to counteract the importation of cars from Germany.

Automobiles imported into Belgium have to pay a tariff of 20 per cent ad valorem; trucks, 12 per cent; motorcycles, 20 per cent; parts and accessories, 12 per cent; and tires, 15 per cent.

A general improvement took place in the industry during the latter part of last year and it is now understood that Belgian manufacturers are well booked with orders, principally for the domestic market. Minerva, for example, proposes to pay a dividend this year, for the first time since the Armistice.

The export trade has been handicapped, as a glance at above table shows, by increased customs duties or import prohibitions in foreign countries

Competition from Germany has been particularly serious. It is stated in the annual report of the Minerva Motor Company that the cost of labor works out to be about 25 per cent cheaper in Germany if the rate of exchange be taken into account. Recognizing this fact and with a view to equalizing German and Belgian prices, the government doubled the import duty on cars coming from Germany. Subsequent depreciation of the mark nullified the effect of this measure.

American manufacturers should note that light, inexpensive cars are favored. The three large Belgian manufacturers—Minerva, Metallurgique and F.N.—are now manufacturing light cars. Imported light cars, such as the Citroen from France and the Fiat from Italy, find a ready sale. British cars are not favored because they are too expensive.

When it comes to motorcycles the British machine is the most popular. Out of a total of 1677 motorcycles imported in 1921, 548 were British. French accessories like French cars lead in imports.

BELGIUM is a light car market. Her own manufacturers supply her with a large number of high grade, expensive cars but it remains for the exporter to supply the necessary light car demand.

For the first three months of this year exports of passenger cars from this country to Belgium have numbered 542. Of this total, 92 per cent, or 500 passenger cars, were priced under $800.

Export figures for this year evidence two things:

1. The demand for the light, inexpensive car.

2. An increase in the export demand.

The well organized system of main and light railways and trolleys coupled with the very poor and unsuitable roads near the industrial centers has given less encouragement to motor transport than found in most countries. This has been particularly noticeable in the case of bus transportation, but a beginning has been made with bus services in Antwerp and Brussels, while the municipal authorities of other districts have been approached with a view to the establishment of motor transport service as supplementing the vicinal railways.

Manufacturers will do well to consider the posibilities of such enterprises, bearing in mind that close co-operation with the local authorities and with the trolley and railroad services will be essential to the success of any scheme of this kind. Vehicles must be of exceptionally strong construction to withstand the effect of the badly paved roads. In connection with operating expenses, gasoline, tires and labor are relatively cheap.

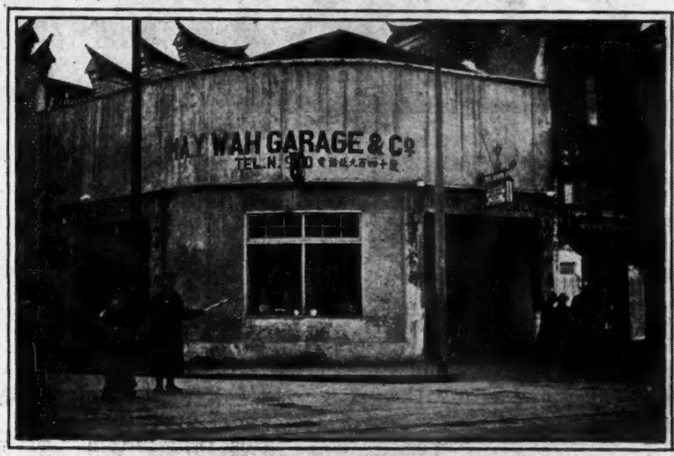
The use of the tractor in Belgium is at present in the introductory stage. This is due to two reasons:

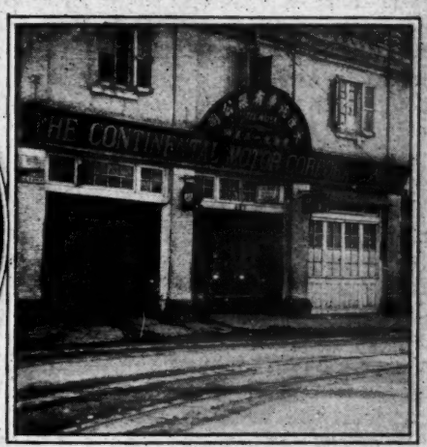
1. The conservative nature of the small farmers.
2. Land tenure being principally confined to small holdings.

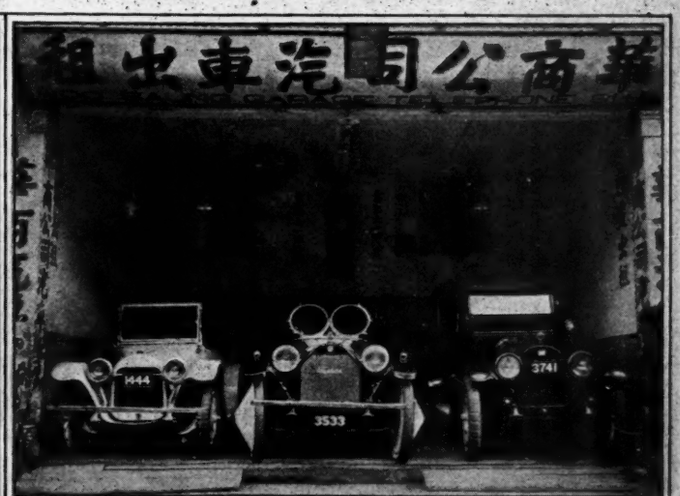
Efforts are being made to increase its use. The 8th Exhibition of Agricultural Machinery was held in Brussels in February and a great variety of both foreign and domestic machinery was displayed. The Boerenbond of Louvain, an important agricultural co-operative society, is doing a great deal to improve agricultural methods and to introduce modern machinery.

Imports of American tractors have been greatly hampered. The policy of the Belgian government is to import tractors from Germany as a payment on account on claims of war damage and then supply them to the farmers. Obviously they consider it to their advantage to get what they can from Germany in the way of finished products.

The Best Service Facilities in China







These garages are located in some of the larger cities in China. The pictures give the American manufacturer an excellent idea of the kind of service his cars will get in the Orient. For these photographs we are indebted to Arthur West, Editor, "Oriental Motor," Shanghai, China.

We like the picture in the upper right hand corner. We think it is symbolic. The stable and carriages occupy a major part of the stage, but the motor car is very clearly shoving its nose into the foreground.

Upson Says, "Complete the ZR-1"

Editor, AUTOMOTIVE INDUSTRIES:

My attention has been called to the editorial in your issue of May 11, "Can Airship Builders Walk Before They Creep?" (dealing particularly with the "ZR-1," now building at the naval aircraft factory) which I think deserves some further comment, if you will allow an individual's opinion a place in your valued columns.

With the first half of your editorial there can be no controversy. There is none, I hope, who does not welcome every possible opportunity of playing safe and still more safe. There is also no reason why a subject like this cannot be thrown open to discussion at any time when there is anything of interest to discuss. My further comments will be in line with your question, "as to the wisdom of continuing with the construction of so large a ship at such great expense as is involved, even though the investigation now requested shows that the design is based upon proper stress calculations and appears to be safe, so far as present engineering knowledge of the subject goes."

It is true that the British for the time being have entirely abandoned their military program of development along this line, but they have not abandoned the civil aspects of the subject. On the contrary, the British Government has done everything which should be most effective in developing and perpetuating a real lighter-than-air craft industry in the British Empire by offering all its present lighter-than-air ships and facilities practically free of charge to properly accredited civil enterprises. That they have had some difficulty in "putting over" this project has not been due to any lack of faith on the government's part, nor to any lack of vision in the ultimate future of airship transportation, but simply to the rather questionable value of the present military ships for use on commercial routes. To bring added pressure to bear, the British Government at one time ordered scrapped all present units, but before this could be put into execution business enterprise asserted itself and the order has since been suspended. Whatever may be the fate of the present ships, it is certain that airship development in England must and will go on, and the biggest contribution that can be made to military "lighter-than-air" will be the establishment of a going commercial industry.

Your assumption that the Germans deprecated the value of large airships for anything but military purposes is entirely wrong. The Zeppelin Company, who not only built the great majority of airships used in Germany during the war, but are generally recognized as the leading authorities on the subject, take quite the opposite view. They feel that the large airship is to become even more important from a commercial standpoint than from a military standpoint. The largest airship built during the war was one of approximately 2½ million cubic feet, yet the smallest unit which they would favorably consider for a trans-Atlantic route is in the neighborhood of 3½ million cubic feet, and technical considerations lead to the belief that airships will be still more economical in sizes greatly exceeding this for either *military or commercial use.* In fact, the very biggest factor for efficiency and economy is mere size alone.

The idea of starting military training with smaller units is of course perfectly logical. Personally I am in favor of doing all our experimenting and training with the smallest practical units, which of course is a relative term because the smallest practical "rigid" construction is much larger than any non-rigid ever built. But suppose we admit that the ZR-1, which our Navy is now building, is larger than necessary to fill its particular purpose. The Zeppelin airships, "Bodensee" and "Nordstern," have proved that rigid airships can be built and operated successfully, to a limited extent, in comparatively small sizes. The only purpose in making the ZR-1 smaller at this time would be to save expense, but progress on designs and material for this ship has already reached such a point that it is far easier, safer and less expensive to complete the ship than it would be to scrap all that has been done and start over again. There are other things about the ZR-1 project of which some of us do not approve, but I do want to say most emphatically that it will provide much valuable experience, that our Navy has been doing all in its power to make it safe and that it should be pushed through to completion without unreasonable delay.

R. H. UPSON.

The Permissible Proportion of Unsprung Weight

Editor, AUTOMOTIVE INDUSTRIES:

From information gathered from several firms up to the present, dealing with lorries and cars, I have drawn the conclusion that with pneumatic tires the unsprung weight should not exceed 15 per cent of the weight of the total loaded vehicle. With solid tires the maximum unsprung weight should not exceed 20 per cent of the weight of the total loaded vehicle.

Taking your case of the the 5-tonner, which weighs loaded 19,800 lb. and has unsprung weight, front and back, of 3925 lb., the unsprung weight in percentage to the load is about 20 per cent, the same as found here in England. Taking the case of your 5-pasenger car weighing, if I am right, 3000 lb. empty, but loaded 3750 lb., adding together the unsprung weight taken from the empty car, which is 7.75 per cent for the front and 15.8 per cent for the back, making together 23.5 per cent of 3000 lb., gives 705 lb. total unsprung weight, and 705 lb. divided by 3750 gives an unsprung weight of 18.8 per cent, which seems to me to be high as I thought that on the best of American cars it was considerably less than even 15 per cent.

The difference between 20 per cent for solid tires and 18.5 per cent for pneumatics sounds to me to be too small. The relationship of unsprung weight on the front to back axle is about the same as you have found.

I had an opportunity of weighing up a 1-ton Ford lorry, this weighed with the load 40 cwt., and the un-

sprung weight was 5 cwt., which is only 12½ per cent. This Ford was fitted with pneumatic tires.

I am writing this to make sure that I have understood your figures thoroughly. P. A. P.

The percentage of the unsprung weight on the rear axle of the passenger car was figured as follows:

Total weight of car empty, 3000 lb.

Rear axle unsprung weight, 15.8 per cent = 15.8 x 3000/100 = 475 lb.

Car weight on rear axle, 53.2 per cent = 53.2 x 3000/100 = 1590 lb.

Passenger weight on rear axle, 4/5 x 750 lb. = 600 lb.

Total weight on rear axle, 1590 + 600 = 2190 lb.

Percentage of rear axle dead weight = (475 x 100)-/2190 = 21.7 per cent.

In comparing this figure with others which have been obtained from manufacturers it must be taken into account that in the above two-thirds of the weight of the springs is taken as unsprung weight, and if the weight of the springs were counted as sprung weight—for which there would be a certain justification—it would make quite an appreciable difference.

It is quite possible that the average American passenger car has a somewhat greater proportion of rear axle unsprung weight than the average European passenger car, because practically all American cars have both service and emergency brakes on the rear wheels, which adds somewhat to the unsprung weight, and they also nearly all have wood wheels, which are somewhat heavier than wire wheels. In this connection it is worth while mentioning that an engineer who had investigated the possibility of reducing weight in modern passenger car design found that one of the best chances was in the hubs of the road wheels.

It is doubtful whether there is another car on the American market that has such a low proportion of rear axle unsprung weight as the Ford passenger car. The whole design of the rear structure seems to have been worked out with low unsprung weight ever in view. In the first place, the heaviest part of the spring is secured to the chassis frame and therefore sprung. By transferring the load from the spring to the axle as close to the wheels as possible, a very light axle housing can be used. Only the emergency brake is on the rear wheels, and this is of exceptionally small size. The wheels, too, are held comparatively light.—*Editor.*

Stresses Due to Transmission Brakes

Editor, AUTOMOTIVE INDUSTRIES:

In your article "Stresses Due to the Transmission Brake," printed on page 730 of the March 30 issue, you say that the strains on the transmission, due to braking and to low-gear pull, have both the same limit, viz.: the road adherence of the driving wheels, and that, therefore, their maxima would be the same.

Now that the transmission brake seems to be getting its chance in the United States, it is desirable that it be not handicapped by misunderstanding of its influence.

Since your article leaves out of account the influence of the transmission inertia, and especially that of the driving-wheels, and since thereby you arrive at a wrong conclusion, I feel sure that you will allow me to add the following:

The strain on the transmission is due to the road adherence of the driving wheels and to the inertia of the transmission, including the driving wheels, but this strain is limited: in speeding up, by the clutch capacity; in braking, by the brake capacity; at uniform speed, with the wheels locked by the road adherence.

Since these three maxima may and do occur, it is only safe to base calculations on the biggest of them, which, in general, will be that of the transmission brake. This strain may be a multiple of that calculated on the road adherence basis. That part of the full brake torque, which is not taken up by road adherence, is effective in retarding the transmission. Therefore, the transmission must be calculated to withstand the highest torque that the brake is able to exert. H. C. OLIVIER, A. S. A. E.

Conservative Airship Development

Editor, AUTOMOTIVE INDUSTRIES:

An editorial in your issue of May 11, page 1031, asks: "Can Airship Builders Walk Before They Creep?"; cites the ZR-2 disaster as an example of what might be expected when constructional ambition outstrips exact knowledge of involved stresses and the means to neutralize same; very pertinently questions the justification in continuing the construction of the ZR-1 ship now nearing completion in Philadelphia, and logically concludes—still questioning—"does it not involve unnecessary risk to attempt building an 'Old Ironsides' before a successful smaller ship of similar type has been constructed and flown?"

The writer is prompted to answer all these questions with an unequivocal and emphatic *yes,* and will not recant even should the ZR-1 (by some happy chance) be successfully completed and safely operated. The chances against such a consummation are too numerous and tragic to enlist any engineer's approval of the enterprise.

The writer is an aeronautic engineer, a balloon pilot, a designer and manufacturer of balloons, dirigibles, and airplanes, whose experience, theoretical and practical, has covered every step and development that has been made in aeronautics and aviation. And this knowledge has led him for years to advocate the very program suggested in your editorial. Although at present engaged in the manufacture of airplanes, he foresees a renaissance of the dirigible, and knows that it can be made a successful system of aerial transportation, if conducted along the sane line of development suggested by you, and provided—the vaulting ambition to produce "the biggest ship in the world" is curbed until the greatest constructional knowledge in the world can be combined with the most plentiful supply in the world of expert navigators and crews; men who will have seen years of service in small, large, and very big ships, before presuming to tackle a job like the "ZR" mammoths.

The writer has been pleased to see his views confirmed, and to confirm yours. JOSEPH A. BLONDIN.

THE Association of the Engineering Graduates of the Liege School, on the occasion of the seventy-fifth anniversary of its organization, will convene an international scientific congress at Liege, June 11 to 16 next. One of the sections will concern itself with reciprocating engines and will discuss the following questions: (A) Large internal combustion engines; (B) high-speed internal combustion engines: (1) study of the means to be employed for increasing the specific power of explosion engines (study of the fuel supply system and of the mechanical efficiency); (2) variable compression engines; (3) two-stroke engines (determinations of the conditions to be fulfilled to enable these engines to be applied to automobiles and aircraft); (4) carburetion; (5) use of vegetable oils in the colonies; (6) study of the super-compressor applied to aircraft engines; (7) application of Diesel and semi-Diesel engines to automobiles and aircraft; (C) compressors working at very high pressures. Other sections will deal with practically every phase of engineering.

Low Wage Scale May Not Mean Low Unit Costs

Fluctuations continually occur in wages. Proper quality and quantity work must be secured regardless of levels of pay. Mental and moral incentives more permanent and effective than wage considerations alone. Effect of money rewards on total unit cost not so great as commonly assumed.

By Harry Tipper

THE recent conference between President Harding and the heads of the steel companies at the White House, and the press notices regarding the twelve-hour day, which was discussed at that time, indicate that labor matters still have a bearing upon Washington's situation. The powers in Washington feel that there are many things to be ironed out if industry is to go ahead thoroughly. In some of the districts in the East where building has become very active in the last few weeks, bidding for workers of various kinds has already raised the wages beyond the union scale at present applying and placed them almost where they were at the wage peak in 1920. Indications come from other centers of bidding between manufacturers where there is a pronounced shortage of certain types of skilled labor and the consequent tendency for wages to return to their high levels, even though the union scale or the accepted scale is very much lower.

These items show the difficulty of depending upon labor prices to reduce production costs and the necessity for securing efficiency which will enable the manufacturer to arrive at a decent cost per piece regardless of considerable fluctuation in the wage scale rate. From time to time we have spoken of the general tendency for wages to retain new levels when these levels have been established and the very temporary character of any recessions therefrom. The events of the past few weeks show the ease with which the depressed prices for labor are changed in view of the slight shortage and the hope of continued activity.

It is useless for the manufacturer to blame the worker for high prices when he himself is willing to bid above the union or accepted scale rate in order to get his work finished. There is not much purpose in enforcing reduced wages, running through the difficulties of costly strikes and rearranging the cost basis for production only to have the labor scale advanced or manufacturers cease to consider it in hiring their own labor.

There has been no bidding between manufacturers in the automotive field for skilled labor as yet, but with the employment rapidly increasing and a shortage in cerain lines of skilled labor, it is not likely that any further recessions will occur and it is not unlikely that increases in the wage rate will have to be met.

THESE fluctuations put the problem back where it belongs and where it has always been centered, regardless of how the manufacturers consider it. The job of the able manufacturer in the matter of labor is to secure the proper quality of work in such quantity that the cost per unit of work will not be excessive in accordance with the sales price. The cost per unit of work is affected by a number of factors.

THE wage rate naturally has its bearing upon this, but it is not the only factor to be considered by any means. Turnover of labor enters into this because of the difficulty of adjusting an organization where the workers are being constantly changed and do not remain at work for any length of time.

The pace incentive is a very important element because there is a wide variation between the general pace established in different manufacturing shops and in different lines of work with different groups of workers. The variation in the average pace is frequently greater than the considerable variation in the wage scale and this variation has a direct effect upon the cost per unit of production.

The flexibility of the organization enters into the cost per unit because of its bearing upon the relation between the capacity overhead and the amount of work turned out. Factories which are operating with a rigid and non-flexible system of operation are less able to withstand a period of under capacity production because of their inability to reduce the cost of the organization in anything like the proportion required for the actual work turned out.

The character of the factory organization also enters into this problem because of its effect upon the accuracy, the amount of rejected work, the promptness and dispatch in connection with shop orders, routine records, working drawings and similar items of factory requirement.

In many of the large factories the organization has had a tendency to grow more rapidly from the standpoint of system than the requirements of the factory would suggest, and, as a consequence, there is a burden of over-systematized operation to be carried in connection with each piece of work done in the factory.

Many manufacturers believed that when wages worked up in the latter part of 1920 and the beginning of 1921 the production problem was largely solved by the cutting of the wages and the increase in the production efficiency. The present activity is already showing a shortage of skilled laborers in many lines. The incentive to increased efficiency will be slowly discarded as the activity is maintained and the demand for the increased rate will be met from time to time as the necessity for more production becomes apparent.

We have maintained in these articles that the influence of the wage rate on production costs was of a questionable value because of the inability to maintain wage rates at a given scale and, therefore, to maintain labor costs from that standpoint. The influence of the other elements in the effect upon the total labor cost in production remains the most important, and these elements are distinctly associated with the character and type of organization in the factory, the wisdom of the personnel work and the general development of the proper degree of understanding so that they are actually under the control of the individual manufacturer more fully than the wage rate.

In those districts in the Eastern section where contractors are bidding against each other for labor so that, unfortunately, the prices paid are equal to the peak prices of 1920, the costs of buildings are not materially less than they were at that time and cannot be lessened except by other means of increasing the efficiency of the labor effect.

The same thing is likewise true all through the industrial system as the activity becomes greater or is maintained at its present pace. The reduction of costs is imperative, if industry is not to be limited in its advance by its own inefficiency. This reduction of costs must come from more effective ways of dealing with labor and not from the arbitrary fluctuations of the labor scale.

Reputation of American Automotive Products Makes for Sound Export Business

FAIR prospects of a steady growth of the motor trade in southern Rhodesia are reported by F. Fisher, British trade correspondent at Bulawayo. The American proportion of import trade is particularly large. In 1919 the value of American cars and parts imported amounted to $160,526, and in 1920 this was increased by $492,800. The value of American motorcycles imported in 1919 was $15,930, while in 1920 the value was only $11,670. England, however, increased her motorcycle trade in Rhodesia, for in 1919 her import amounted to but $10,730, and in 1920 it rose to $37,945.

Another item reflecting the prosperity of the province concerns farm implements, which in 1920 showed an 84 per cent. increase over 1919.

COMMERCIAL ATTACHÉ ARNOLD reports from Shanghai to the Bureau of Foreign and Domestic Commerce that motor car and tire dealers of China are showing a tendency to standardize on American sizes of tires, and that practically every dealer is instructing his manufacturers to equip any cars shipped to China with American sizes. At present European sizes, known as "millimeter clinchers," of every size are in use, as well as American types of both the clincher and straight side of inch sizes.

The Bureau also has received a report on the use of spark plugs at Tsingtau, where practically all cars are of American make. The plugs also are practically all of American manufacture, except for one British plug, the "Lodge."

THE rubber goods trade in Germany has flooded the markets of Switzerland, according to a report from Con-Willrick, St. Gall. During the period of the late war German goods grew scarce, British goods generally taking their place. Some American firms also were successful in introducing their products and even established agencies in Switzerland. Most of these have been closed again and those remaining specialize in automobile, motorcycle and bicycle tires. American tires, being considered at least as good as other makes, are in fair demand.

THE large proportion of American tractors now being used in Poland should be helpful in increasing the sales of American implements and tractors in that country, states a cable to the Agricultural Implement Division of the Department of Commerce.

A census of tractors in Poland, just made, shows that there are 1300 tractors in use, of which 1204 were imported. Of that number 1055 were imported from the United States and represent ten different American makes of machines. Practically all tractors imported have been shipped in within the past three years. All machinery of every type, during the war, was destroyed.

Next to the United States, Austria has supplied the largest number of tractors. Of the 45 originating in Austria 25 were Austrian built and mounted in Poland. Germany was third with 37 tractors, Finland fourth with 30. Czechoslovakia, Italy and England furnished a number of tractors equal to that from Germany. Some of the American tractors now in Poland are war-time stock, purchased from Italy and other allied countries. The type which seems to be in greatest demand is a wheel tractor of 10-25 hp. Of the 1300 machines in use, 1290 are wheel type machines, the other ten being track-laying types.

AUTOMOBILE and bicycle tires constitute the principal articles of rubber goods imported into the Aleppo district, though on account of the disturbed political conditions and the limited demand for transportation facilities, the market for tires is far from good. There are about 140 passenger cars and 55 trucks in the district. Seventy-five per cent of the tires in use are of the inch clincher type, the balance being metrics. Fabric tires are preferred because of the lower initial cost and represent 85 per cent of the tires used. American tires enjoy the greatest sale because of the high quality and low cost. The garages buy both direct and through commission agents. Terms are usually 25 per cent down, balance against documents. As the roads are very poor the annual tire consumption per car is much greater than in the United States. Red inner tubes are preferred.

THE extremely high cost of transportation of gasoline into the interior of the Belgian Congo, largely due to tsetse flies, which make it impracticable to use animals for transporting goods and necessitate the use of native porters, led the Belgian Colonial Ministry to organize a trial of road tractors using palm oil as fuel. The results of these trials gave full satisfaction. The semi-Diesel two and four-cycle engines ran normally on the palm oil, and the power developed was equal to if not greater than that obtained with kerosene. Nothing was noted that suggested possible difficulties in using palm oil in these engines. Starting up, without gasoline injection, was good, and there was no carbonization.

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That Luxury Argument

A PROMINENT banker and economist stated recently that he was much surprised at the rapid recovery of the automobile industry, for he did not think that it was justified by general business conditions. He had concluded that it was due to the fact that the automobile is now an accepted need in the daily life of Americans as is the telephone.

The bathtub and the telephone have been at certain times in the history of our country considered luxuries which should not be encouraged. Such an attitude is inconceivable now. It is probable that the automobile will soon be as readily accepted in the scheme of life as previous innovations. Indications are that it is very near that point. The argument that automobiles are a luxury is growing weaker.

Discussions about the future of the industry often revolve about the subject of the saturation point as if it meant disaster or a sudden slowing down in production. Probably it is not always realized that if such a point were possible to be reached that the industry would still be one of the biggest in the country.

When the industry approaches the point where further increase in production depends on an increase in population the automobile will be an accepted universal necessity and—well, automotive executives and engineers will still have their problems.

Mixed Fuels—Reasons for Their Popularity Abroad

IT will have been noticed that abroad, whenever the substitution of other fuels for gasoline has been proposed, the substitute usually has been a mixture of a number of simple compounds of entirely different derivation. For instance, the German standard fuel is a mixture of tetraline, alcohol and benzol.

The question naturally arises—if gasoline is to be done away with, why not adopt some other simple fuel, the one which possesses the most merit?

There are several reasons for the use of compounded fuels. The chief one undoubtedly is that none of the possible substitutes is available in sufficient quantity to meet the requirements. Alcohol could be produced in sufficient quantity if the matter of cost could be neglected, but this is not the case, as the very object in replacing gasoline is to cut down the expense. To supply pure alcohol for a portion of the automotive apparatus in the country, leaving the rest to be supplied with other fuel, would not be a practical plan, because it would greatly increase the difficulties of distribution. To take full advantage of the possibilities of alcohol it would be necessary to design the engines specially for this fuel, as a much higher compression is required and the conditions of vaporization also are different than with the present day gasoline.

In making any change in the fuel marketed, the limitations of the automotive equipment already in existence must be taken into account. Evidently it is this consideration which decided the French, in looking for a national fuel to limit the alcohol admixture to 10 per cent. The original plan, it seems, was to develop a mixture all of the components of which were of native production, and the use of a half mixture of benzol and alcohol was contemplated. But the conclusion seems to have been reached that it would be absolutely impossible to secure enough of this mixture at a price at which it could compete with gasoline to supply the needs of the automotive field. Gasoline, therefore, could not be dispensed with, at least not for the present. A limited quantity of alcohol can be produced comparatively cheaply, largely as a by-product of other industries, and to create a market for this by-product the 10 per cent mixture is proposed as a standard fuel and its compulsory use urged. It is evident that the properties of such a fuel cannot differ much from those of straight gasoline, and no difficulty need be anticipated in connection with its use in equipment designed for gasoline.

From the standpoint of the American automotive industry the adoption of substitute fuels in foreign countries is a fortunate thing, for it will relieve somewhat the competition for petroleum fuels.

Looking Ahead

BUSINESS conditions in general have accelerated considerably during the last month. All industry is not yet on a level with the automotive industry, but steady gains have been made all along the line. This generally increased activity of business will enable automobile manufacturers to keep their production schedules very near to capacity during the month of June.

Permanent prosperity in this country will depend largely upon the stabilization of European conditions. Europe is the normal consumer of our excess products, especially raw materials, and until it is able to buy in its usual volume our domestic market will not be thoroughly stabilized.

Foreign trade increased last month, however, while exchange has been strong, many of the important exchanges holding to high levels. The promise of an early settlement of the question of German reparations is having a steadying effect. The world winter wheat crop is in good condition. Reports from Central Europe are specially favorable but warmer weather is needed in France and Great Britain.

This definite trend toward increased foreign business and greater industrial stabilization in foreign countries indicates a sound basis for continued revival of business in America. The fundamental return of sound conditions, moreover, will have a particularly favorable effect on the truck market during the last months of this year, since the farmer, more than any other producer, is dependent upon European stability for continued prosperity.

The South is likely to be the weakest buyer of automotive products during the next month. Heavy floods and adverse planting conditions in the cotton belt indicate the possibility of a cotton crop below normal. Retail sales have been excellent in the West and conditions point to a continuance of favorable buying in that section.

The continuance or settlement of the coal strike will have considerable bearing upon conditions in certain sections and industries. Some of the larger manufacturing plants will undoubtedly begin to feel the pinch of lack of fuel within the next thirty days, unless the strike ends or current supplies are increased in some way. A continuance of the coal strike, however, is likely to affect automobile productions more seriously than automobile sales demand during the next quarter.

Unemployment has materially decreased and is a thing of the past so far as the automotive industry is concerned. In certain instances there is serious competition for labor already, and possibilities of rising wage rates are looming up because of this labor demand.

The money market is good. Comparatively easy rates prevail. No money stringency has yet developed, despite the greatly increased industrial and commercial activity. This is resulting in greater facility in financing automotive sales.

All previous building records were shattered during April, and activity was continued during May. Car loadings increased during May, while iron and steel output showed another gain.

There is a definite feeling evidenced by executives in every line of industry that business is now definitely on the upgrade. It was noticeable, however, that the executives gathered at the U. S. Chamber of Commerce meeting two weeks ago were saying that "Business has turned the corner," not that "We are back to capacity production," as the automotive industry has already been able to state.

Thus it appears that some hesitation in automobile and truck production is likely during the third quarter. Conditions at this time, however, indicate that the hesitation will be comparatively slight, far less than could have been predicted with confidence two months ago. The continuance of steady but conservative buying and sane production plans will insure the automotive industry against any shock.

Another Big Month Predicted for June

Orders Continue to Flow into Plants—Second Quarter May Set Record

By JAMES DALTON

NEW YORK, May 29—Most passenger car companies have endeavored to speed up operations in the final week of May in an attempt to establish new production marks and offset the loss of output on Memorial Day. June will bring no sharp slackening of activities for a flood of orders still is flowing into the plants. If the second quarter is not the largest ever recorded for passenger car production it will be close to it.

Less than a month ago it was generally expected that the third quarter would bring a decline in sales but the industry now is becoming confident that there will be only a seasonal falling off. Some makers feel that the third quarter will be about on a par with the second. The results will depend largely upon the farm market and conditions in the south. There are strong indications of large sales in the agricultural sections when the harvests begin and there already is considerable demand in these districts.

Truck Production Increasing

Truck production is increasing month by month although improvement has not been as spectacular as in the passenger car field. Sales are likely to increase steadily until November, at least. More farmers than ever before are considering the purchase of commercial vehicles and many of those now in operation will be replaced as soon as possible.

Practically all parts plants are operating at capacity and a considerable proportion are employing day and night shifts. Sales in April showed a gain of 20 per cent over March and May probably will record another equally large expansion in business. Some vehicle manufacturers still are handicapped by a shortage of essential parts and materials.

Closed Car Demand Grows

Nearly all large passenger car producers report a steadily increasing call for closed models. Several new models or additions to established lines have been brought out recently and more are in prospect. If there is any tendency for demand to slacken in the early fall, new models are expected to revivify it.

(*Continued on page* 1187)

Business in Brief

NEW YORK, May 29—Optimism in larger measure features reports of business and industrial conditions in all sections of the country. A survey of the Middle West shows that conditions are better than at any time in two years.

The improvement applies generally to trade, industry and crops. Improvement has not been uniform but it has been almost universal. Retail buying and jobbing distribution have shown most progress in the Western surplus grain producing states.

Perhaps the most encouraging reports relate to the crops. They show much lost time made up, especially in corn planting; further improvement in winter wheat; good reports from hay and pasture lands and a good if late start for spring wheat. Cotton is late getting started.

Steel mills are well filled with business for the next two or three months. Freight car orders now have reached a total of 75,000 for the year. A few plants plan to increase their capacity. Production of steel ingots is at the rate of about 38,000,000 gross tons a year compared with 35,000,000 tons on April 1 and 20,000,000 tons in December.

Freight car loadings have increased, great activity in building continues, and the strength of raw textiles continues to be a feature of interest.

Employment reports are favorable, although the coal trade and the cotton manufacturing industry in New England show little gain. Shoe factories are fairly active except in New England where there are labor troubles.

Stocks are irregular, bonds firm and sterling steady.

Bank clearings for the week ending May 25 aggregated $6,866,225,000, a loss of 1.6 per cent from the previous week but a gain of 21.7 per cent over the same week last year.

WINS LE MANS FUEL TRIAL

PARIS, May 29 (*By Cable*)—A new model overhead valve Citroen four passenger car won the LeMans fuel consumption trial, covering 100.5 miles with an allowance of 1.49 gallons of gasoline at a minimum speed of 25 m.p.h.

DIRECTS A. E. A. FOREIGN TRADE

CHICAGO, May 30—A foreign trade committee composed of the following has been appointed by the Automotive Equipment Association: S. D. Black of Black & Decker Co., Baltimore, chairman; N. H. Oliver of Metal Specialties Manufacturing Co., Chicago, vice chairman, and F. B. Caswell, Champion Spark Plug Co.

Wing Firm to Make Car Gunn Designed

Incorporated for $10,000,000—Product Now Known as "Canadian" in Canada

BINGHAMTON, N. Y., May 26—The Wing Motors Corp. is incorporated under the laws of Delaware for $10,000,000 to establish a plant in the city of Binghamton for the manufacture of the Wing automobile, the principal feature of which is the front spring suspension, two springs being placed transversely across instead of in line with chassis. A Continental six cylinder motor is used and other parts are standard.

The car is designed to sell for about $1,800. Two million shares of stock are preferred stock of $100 per share par value, and 800,000 shares common stock without par value. The officers are: William Lorimer of Binghamton, formerly of Detroit, president; Philip Hamlin of Binghamton, previously of Denver, Chicago and New York, and former executive of the American Telephone & Telegraph Co., senior vice-president; Albert E. Fowler of Binghamton, formerly of Detroit, secretary; Edward G. W. Ferguson, previously New York broker and formerly with the Harriman Bank, vice-president in charge of finance. Brown and Swartwood of Johnson City are the attorneys.

No Stock Yet Issued

Lorimer and Hamlin are to be directors, with Isaac F. Pearsil of Brownsville, Pa., and four Binghamton men to be chosen later. No stock has yet been issued, and the site of the plant has not been selected, although negotiations are pending for the $500,000 Hires tin can plant owned by the Nestles Food Co. in this city. The designer of the car is Earl G. Gunn, formerly chief engineer of the Packard Motor Car Co. A company already has been organized in Canada to manufacture the car under the name of the Canadian.

American Car Takes Over Carter Carbureter Plant

ST. LOUIS, May 29—The plant of the Carter Carbureter Co. in this city has been taken over by the American Car & Foundry Co. and will be operated as its carbureter division. Sales and service will be handled by a separate company known as the Carter Carbureter Corp., with headquarters at the factory.

Hugh H. C. Weed, who was in charge of the old company, will also be general manager of the Carter Carbureter Corp. and will have associated with him practically all the old Carter organization, including G. M. Bicknell as chief engineer, R. H. Herron as field engineer and H. S. Staton as sales manager. C. E. Burg will represent the company on the east coast, with headquarters in the offices of the American Car and Foundry Co. at New York and V. G. Lowenstein will cover the middle west.

Special Equipment Demand Increasing

Buses and Trucks Form Good Part of Business of Milwaukee Manufacturers

MILWAUKEE, May 29 — Pressure upon manufacturers of automotive parts and equipment by passenger car builders in all production centers continues to increase as the result of the intensive effort made by the industry to bring car output as close as possible to demand. The car factories in this center and vicinity are working hard in this direction, but unfilled orders have shown a further enlargement in the past week.

In the motor truck industry, manufacturers here have adopted a much more optimistic attitude than they have had for about two years, as the result of a better response to the merchandising efforts of truck dealers everywhere. The motor bus is taking a prominent place among the principal sources of demand, while the call for special equipment, such as trucks with dump bodies, hoists, etc., for purposes like highway construction, general building construction and fuel hauling is also reaching a high level. Some factories are doing more business in the more specialized equipment than in standard, commercial trucks for commodity transportation.

Tractor Situation Better

There have come to notice no particularly striking instances of marked development in tractor and power farm operating equipment manufacture, but the situation is steadily growing better. Jobbers and dealers are engaged in strong effort of a general sales promotion nature, in addition to current selling, the former having special reference to the time when the farmer will be better fortified in a financial way.

Manufacturers in all phases of the iron, steel and machinery industries are exercising rather unusual caution, especially in preventing inventories from becoming over-balanced, in order that they may avoid disastrous experience of the past. This has developed a situation in which production frequently is temporarily restricted by inadequate supplies of materials of all kinds, but usually it is possible to overcome this condition without serious interruption.

Local Sales Good

The month now ending takes rank as the most satisfactory in the last 18 to 24 months in respect to the volume of sales of passenger cars made by dealers in Milwaukee and generally throughout Wisconsin.

MOONEY MEETS PLANT HEADS

DETROIT, May 29—J. D. Mooney of New York, vice-president and general manager of the General Motors Export Co., conferred with plant managers in this district this week preliminary to his departure on a business trip to South America. Export business in the past five months has doubled that of the same period last year, he said. He noted that the tariff zone made up of countries of western continental Europe, including Scandinavia, which recently was at the bottom of the list in volume of sales, has advanced to a point where it now leads all the markets of the world with the exception of America.

Lower Freight Rates Will Help Business and So Benefit Truck Industry

By DON F. WHITTAKER,

Manager of the National Association of Motor Truck Industries

Detroit, May 29.

REDUCTION of freight rates by the railroads on July 1, as decreed by the Interstate Commerce Commission, should prove to be an important stimulus to general business, and as such will react favorably to the motor truck interests. A reduction has been expected for some time, and though somewhat smaller than expected, it is, nevertheless, important to general business.

Consideration of the effect that lower rates would have upon the motor truck business has led to the belief among truck makers that the change would be favorable. There will be some slight loss of business in some sections to motor truck operators, but this will be more than compensated for by the increased business that motor truck operators will get as railroad business revives.

The new railroad rates will be lower than the cost of hauling by motor truck only in some of the more congested manufacturing districts of the country, but even there the truck rates, including the door-to-door pick-ups and deliveries, should be lower on the whole than the rail cost. Then there is the time element to be considered, which is vastly in the favor of the truck.

The industry will be directly benefited by the savings on shipments of parts and material, and dealers will be able to offer trucks for sale at a price lower than present prices with war tax and freight included. All of these factors will make for increased business in the truck field. Manufacturing is continuing to gain steadily in volume and indications are that it will continue to do so.

Szarvasy Coming Here for Dunlop Financing

BUFFALO, May 29—F. A. Szarvasy, chairman of the board of the Dunlop Rubber Co., Ltd., is on his way from England to arrange new financing for the American Dunlop Rubber Co. Sir Eric Geddes, a brother of the British Ambassador, has been elected a director of the British company.

The statement is made by Samuel B. Botsford, a Buffalo attorney, who has just returned from England, that British officers of the Dunlop company are very optimistic regarding the future of the Buffalo plant. This tends to confirm reports recently received here that the new plant in this city may soon be in operation.

Botsford said that the new Dunlop tire plant at Birmingham, England, is producing on a large scale and that the company employs 15,000 workers in its English factories.

NO DUTIES TO HONDURAS

WASHINGTON, May 27—The tariff division of the Bureau of Foreign and Domestic Commerce has been notified that automobile and automotive equipment will continue to be admitted into Honduras without import duties.

Sales in Southeast Point to Normalcy

ATLANTA, May 29—Automotive sales conditions in the southeastern territory have improved so rapidly during the past six weeks that a majority of the dealers and distributors are of the opinion that the periods of business depression has now definitely become a thing of the past. All signs indicate returning normalcy, and with some dealers business now is even better than normal.

The Atlanta branch of the Ford Motor Co. reports the past two months the best in the history of the branch, and practically all of the Ford dealers in the larger cities of this section are from two to four weeks behind with their orders. The Atlanta branch of the company is now building an average of 100 cars daily but cannot keep up with demand. The larger Atlanta Ford dealers, A. L. Belle Isle, the Beaudry Motor Co. and David T. Bussey, all state that they are weeks behind in filling the orders now in hand.

In Florida practically all makes of cars are in excellent demand, with gross business appearing to be about 10 per cent better than it ever has been.

The Atlanta branch of the Buick company reports the sales volume having increased more than 200 per cent the past six months.

Registration figures for Atlanta alone, including new and used passenger cars and trucks, were 440 during the week ending Sunday, May 14, and 520 during the week ending Sunday, May 21. This is several hundred per cent better than registrations of five or six months ago, indicating a rapid and steady improvement in automotive sales in this section.

Territories Combed in New Sales Plans

Present Rush of Ford Business Due to Thorough Canvass of Country

DETROIT, May 25—Sales plans as being developed by leading companies in the Detroit district will result within the next year or two in the establishment of merchandising systems which will control very definitely the problem of reaching the prospective buyers of cars.

Such systems, though long regarded as necessary to insure the solidity of the industry as a whole, were compelled to await the arrival of a long period of depression before they could be worked out and tested at length. The recent period presented the opportunity, and the present season is witnessing their successful demonstration.

Ford at Highest Production

Ford Motor Co. officials, with the factory working at the highest production pitch it has ever known to keep pace with demand, ascribe the present rush of business to a thorough sales canvass made throughout the country in the dull period of last winter. At that time the sales force in every section was assigned the task of getting a definite idea of sales prospects, especially in the farming districts.

Sales to-day are said by officials to be really sales made during this canvass. Dealers were given exact knowledge as to where sales might be expected and were enabled to place their efforts where they would be most effective. There is nothing "chancy" about the business that has developed, though that it has been heavier than was expected even by the Ford interests is shown in the fact that the factory is working six full days weekly where it had been planned to adopt permanently the five day week.

Studebaker Has Similar Methods

Throughout its business career the Ford company has been benefited materially by the numerical strength of its dealerships and also by the extensive sales staffs that have always been maintained by its dealers. By the adoption of similar methods the Studebaker company has risen to a foremost place among the medium price car makers.

Though both the Ford and Studebaker distribution is handled through the branch system, those factories which depend on distribution for the turnover of their product are coming out for increased dealerships and more salesmen. Territories formerly held by one distributor are being divided into many smaller sales sections with a dealer on the spot to keep in immediate touch with the district.

Recently General Motors has gone in energetically for the subdivision of territories and the placing of dealers at points where the volume of sales was not considered up to possibilities. An intensive system of covering a territory is being developed by the advisory staff through the medium of one of its Detroit branches, which when perfected will be recommended for standard practice by all dealers handling General Motors lines.

Under this system every listing of residents compiled for any municipal, national, business or other reason will be consulted and analyzed for information which will be helpful in promoting sales. Dealers will be instructed in the lists to consult, how they may be obtained, the analysis of them, and how to use the information which they may be found to yield.

FARMER BIG FACTOR IN OVERLAND SALES

TOLEDO, May 29—Records of the Willys-Overland Co. show that purchases of Overland cars by farmers in April were almost double the purchases by any other vocation. Salesmen, laborers and merchants ranged next in order, each group taking approximately the same number of cars. Clerks followed in fifth place, with approximately one-quarter as many cars as were purchased by farmers.

Another fact brought out by the analysis of sales is that more than one-third of all Overland cars purchased this year were bought by persons who never owned a car before.

Former Cotta President Is Not Liable for Debts

ROCKFORD, ILL., May 31—T. D. Reber, former president of the Cotta Transmission Co., which failed, will not be liable for the debts of the corporation, according to a decision of Judge R. K. Welsh in the case of the Belvidere Screw & Machine Co. against him. The court held that Reber did not assent to the contracting of debts by the company over and above the capitalization, and, therefore, could not be held liable for debts in excess of the capital stock.

The court also ruled that Reber could retain the salary he drew in 1919 and the preceding years but must return the salary paid to him in 1920. He drew $5,000 per annum. This sum will be made part of the assets and will be distributed among the creditors.

MOSLER ASSETS TAKEN OVER

NEW YORK, May 29—The assets of A. R. Mosler & Co., which has been in the hands of receiver for a year and a half, have been taken over by a new organization. The plant at Mount Vernon will be operated hereafter as the Mosler Metal Products Corp. In addition to the line of spark plugs which the company always has made, several automobile accessories will be added as well as a full line of radio equipment.

Fisher Takes Over Old Cadillac Plant

Will Enter Field of Custom Body Building on Large Scale

DETROIT, May 29—Fisher Body Corp. has taken over the former Cadillac plant on Cass Avenue, where it will extend its present body manufacturing operations and enter, for the first time on a large scale, the field of custom body work. Offices for the sale of the custom work will be opened in New York and Chicago. The plant contains 650,000 sq. ft. of manufacturing space and will employ 2000 men.

The purchase of the plant also includes the section taken over by R. H. Collins, following his resignation as Cadillac president, which was intended to be the manufacturing site of the proposed Collins car. Following the purchase by Collins and associates of the Peerless company, Cleveland, the Detroit holdings were placed on the market. Collins still maintains, however, his home at Grosse Point.

In a statement indicating the proposed Fisher plans, Fred Fisher, president of the company, said a number of leading body designers had been engaged who will specialize on fine work. Workmen for the new plant will be selected from the 20,000 men now employed in the several Fisher plants in the city.

Recent Truck Executive Will Head Arrow Motors

SANDUSKY, OHIO, May 26—A. C. Burch, former president of the Signal Motor Truck Co. and later vice-president of the Clydesdale Motor Truck Co., will be president of the Arrow Motors Co., recently incorporated, which took over the assets of the Maibohm Motors Co. The other officers will be Sandusky business men. The directors will include R. E. Hayslett, treasurer of the Hydraulic Steel Co. of Cleveland; E. G. Kirby, vice-president of the Commerce-Guardian Trust & Savings Co. of Toledo, and N. T. Brotherton, president of the Brotherton Co., Detroit.

While creditors have a large interest in the new company, Sandusky stockholders retain important holdings and will have a majority on the board of directors. It is asserted that stockholders who did not go into the new company will lose their investment. More than 80 per cent of the creditors agreed to the reorganization plan, and the property was bid in by Kirby as the representative of a creditors' committee.

LOWER FEES HIS PLATFORM

DAVENPORT, IOWA, May 29—Walter C. Ramsay, secretary of state, candidate for re-election, is making his platform upon advocacy of a 33 1/3 per cent reduction in licensing motor vehicles.

Tire Makers "Wait" in Price Situation

Watch Each Other Following Moves Made by Seiberling and Goodyear

AKRON, May 27—Although tire manufacturers in Akron and vicinity are trying to minimize reports current for some time to the effect that a tire price war was impending, the introduction by the Goodyear Tire & Rubber Co. of a new cross-rib cord tire to sell at nearly 25 per cent below the standard cord tire market lists, and the announcement by the Seiberling Rubber Co. of a blanket 12½ per cent price slash on Portage and Seiberling straight side tires, on top of the price revisions made by Seiberling the first of May, admittedly have caused an upheaval of no small proportions among tire manufacturers and have upset carefully worked out programs for an anticipated upward revision of tire prices.

Regard New Tire as Price Cut

The new Goodyear line of tires was introduced at a psychological time to thwart the plans of competitive companies, for announcement of tire price increases about the first of May. Introduction of the new line is considered tantamount to a price cut, in view of the fact that the new cross-rib casings will sell at from 20 to 25 per cent below the standard lists of the Goodyear All-Weather tread cords and of most other standard cord tire makes.

Almost simultaneously with the Goodyear announcement, Frank A. Seiberling, who founded Goodyear 23 years ago in a dilapidated straw board box factory in East Akron, revised his prices on Seiberling cords down to the standard market lists, and put into effect a ten per cent cut on all Portage tires.

The combined action of Goodyear and Seiberling has forced a change in the plans of other rubber companies, which are known to have had new price lists drafted and ready for the printers. And these new price lists embodied substantial increases.

Abandoned New Tire

One Akron company feverishly developed a new tire to sell at prices competing with the new Goodyear tire. It was submitted to hurried tests and then it was discovered that the tire was too good to sell for so low a price, and that it could not be profitably marketed to compete with the lower priced casings. Realizing the futility of putting another high grade and high priced tire on the market, the company has about decided to abandon the new tire completely.

The Amazon Tire & Rubber Co. has put out a new cord tire to sell at fabric prices. Firestone has increased the dealers' marginal profit and has made a slight reduction to the consumer.

Officials of other companies here decline to comment upon the Seiberling price cuts or on the new Goodyear line. Yet each is watching the other—alert for new developments in the price war and waiting for the other fellow to make the first move. In other words it is the old "Watchful waiting" lid clamped down upon a situation that is liable to break forth with the rush of a volcano and to further disrupt the price situation.

Manufacturers last year took heavy inventory losses, slashed prices about 40 per cent and barely breezed through. Sales to-day are larger than a year ago, partly because prices were cut three and four times—approximately about 40 per cent in all. The sales in dollars are considerably lower, however, although the sales in units are larger.

Firestone Increases Wages

AKRON, May 29—The tire industry in Akron faced a new upheaval and a wage war, as well as a tire price war today, when the Firestone Tire & Rubber Co. announced a wage increase averaging 10 per cent, to become effective immediately for all its factory employees. Firestone is the first rubber company to increase wages following the comeback staged by the entire industry.

Officials of other rubber companies admit they are surprised by the Firestone action, but will make no comment as to the future action of their own companies. On good authority, however, it is learned that at least one more of the major plants will announce a wage increase on Saturday, and that another of the larger will take action tantamount to a wage increase by reducing the hours of factory shifts and continuing the same pay.

Firestone's action to-day was taken to avert labor trouble. There has been much dissension lately in the ranks of tire workers, and several minor walkouts over wage disputes have taken place in numerous factories. A few Firestone men to-day quit work, claiming the wage increase was not enough, but officials of the company expect them all to return to work within a few days.

BROADWAY ASKS BUSES TO REPLACE TROLLEYS

NEW YORK, May 29 — The Broadway Association, Inc., has filed with the Transit Commission a suggestion that surface cars be removed from that famous thoroughfare and buses substituted. The communication of the association states:

"The operation of surface cars not only works to the disadvantage of those with property and business on Broadway, but serves to retard and interfere with other modes of vehicular traffic on the street and to reduce the volume of such traffic to an extent which bears upon the general usefulness of the street and its value for business purposes."

Continental Awards Castings Contract

Ryan-Bohn Gets Order Incidental to Manufacture of Star Engines

DETROIT, May 26—Contracts to furnish castings for 100,000 engines has been awarded by the Continental Motor Corp. to the Ryan-Bohn Foundry Co. of Lansing. This contract is incidental to the manufacture by Continental of engines for the new Star car, work upon which will get under full headway at the Muskegon plant in June.

The Ryan-Bohn company will begin making deliveries under the contract the first week in June. Included in the castings will be cylinders, cylinder heads, pistons, fly-wheels and other smaller parts. The Muskegon plant of Continental has been completely equipped to handle the quantity production for the Star, and workmen forces are being assembled as rapidly as possible.

Big Body Contract

Hayes-Ionia Co., Grand Rapids, reports the closing of contracts for $15,000,000 worth of bodies to be completed by June 1, 1923, about $12,000,000 of which represents bodies to be furnished for the Durant Motor Co. The new orders will require the erection of two units to the present plant, work on which will be started at once.

The company is turning out 70 bodies a day at present, and it will be necessary to increase this capacity to 150. The present working force will be increased from 950 to 1500.

General Tire Declares Its Quarterly Dividend

AKRON, May 29—The General Tire & Rubber Co. of Akron, one of the few rubber companies that did not suspend dividend payments during the slump period, has declared its regular quarterly dividend of 1¾ per cent on preferred stock, payable July 1 to stock of record June 20. The company on May 1 paid a regular quarterly dividend of 2 per cent on common stock.

Production at the General plant in Akron is running in excess of 2500 tires a day, officials report, which is far above the company's peak record of output during the wave of prosperity experienced by the tire industry just before the slump came in May of 1920.

INSPECT FORD VIRGINIA SITE

NORFOLK, VA., May 29—A party of engineers representing Henry Ford and headed by Colonel Mayo has inspected the site which it is reported has been tentatively selected as the location for the principal Ford assembly plant on the Atlantic coast for export trade. Ford representatives had previously made careful survey and it is reported an option on the site has been obtained.

Export Sales Mount Toward 1919 Record

Efforts Being Made to Surpass Mark Established in Second Biggest Year

WASHINGTON, May 26—The international sales of American made automotive equipment are making as striking gains as those recorded in the domestic markets. A rate of overseas shipments has been reached indicating that 1922 will surpass all other years in the history of the industry, except 1920, when buying in the export markets was at feverish heights.

The totals for passenger cars during the first four months of the year are within 20 per cent of the shipments for all of 1921, and it is apparent that the exporters of American automotive equipment are out to surpass the 1919 record, second largest of the industry, and if the present rate is continued, the year will make a surprising comparison with the swollen total of 1920.

The automotive division of the Bureau of Foreign and Domestic Commerce has announced the export figures for April, following the receipt a few days ago of the Canadian totals for the same month. Shipments from the United States comprised 6438 passenger cars, 879 motor trucks and parts valued at $3,933,488. By adding the Canadian business (announced in the May 25 issue of AUTOMOTIVE INDUSTRIES), the April shipments of North American cars reached the surprising figure of 8750 passenger cars and 975 motor trucks.

Shipments Tripled

Details of the United States shipments, giving the various classifications of cars and trucks, with values, are shown in an adjoining table. Comparison with the preceding month of March and with April, 1921, are as follows:

	April 1922	March 1922	April 1921
U. S. shipments			
Passenger cars	6,438	4,471	2,311
Motor trucks	879	590	270
Canadian shipments			
Passenger cars	2,312	2,983	415
Motor trucks	96	172	63
Total Canadian and U. S. shipments			
Passenger cars	8,750	7,454	2,726
Motor trucks	975	762	333

Thus, both passenger cars and trucks are being sent forward to overseas territories at a rate three times that of the same month a year ago, and reports to Washington indicate that May will uphold or exceed the April totals. Other comparisons are fruitful in an understanding of the rapid expansion being made in our foreign trade on automotive equipment.

The following relates to passenger cars:

U. S. shipments twelve months, 1921	30,941
U. S. and Canadian shipments, January, February, March and April, 1922	25,770
Monthly average (6,442) if maintained, indicates 1922 shipments of	77,304
U. S. exports, 1919	67,144
U. S. exports, 1920	142,508

The comparison in regard to motor trucks is:

U. S. shipments motor trucks twelve months, 1921	7,402
U. S. and Canadian shipments, January, February, March and April, 1922	3,027
Monthly average (757) if maintained, indicates 1922 shipments of	9,084
U. S. truck exports, 1919	15,485
U. S. truck exports, 1920	29,126

The present volume of exports shows an increase of several hundred per cent over the low point made during 1921. For passenger cars, the June, 1921, totals for the United States and Canadian trade were down to 1967 vehicles, comparing with the April, 1922, volume of 8750. For trucks the low of 270 in August, 1921, has risen to 975 for April. Parts shipments have more than doubled in value, despite the decline in prices, and no month since January, 1921, has been comparable to April in this part of the overseas trade.

Exports, Imports and Reimports of Automotive Products for April, 1922, and for Ten Months That Preceded

	Month of April				Ten Months Ending April			
	1921		1922		1921		1922	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles, including chassis (Total)	3,078	$3,743,074	7,337	$5,533,275	96,705	$126,942,168	35,331	$30,483,112
Electric trucks and passenger cars	....	....	20	35,791	....	....	97	148,642
Motor trucks and buses, except electric	609	811,841	....	....	16,718	28,186,022	2,727	2,851,223
Up to 1 ton	....	....	580	234,455	....	....	1,454	650,506
Over 1 and up to 2½ ton	....	....	226	273,907	....	....	760	1,020,507
Over 2½ ton	....	....	73	166,385	....	....	173	410,957
Total motor trucks and buses except electric	609	811,841	879	674,747	16,718	28,186,022	5,114	4,933,193
PASSENGER CARS								
Passenger cars, except electric	2,469	2,931,233	....	....	79,987	98,756,146	13,708	12,164,579
Value up to $800	....	....	4,023	1,670,297	....	....	9,816	4,747,013
Value over $800 and up to $2,000	....	....	2,211	2,506,904	....	....	6,033	6,682,368
Value over $2,000	....	....	204	645,536	....	....	563	1,807,317
Total passenger cars, except electric	2,469	2,931,233	6,438	4,822,737	79,987	98,756,146	30,120	25,401,277
PARTS, ETC.								
Parts, except engines and tires	....	3,195,698	15,588,304	3,933,488	....	64,993,319	....	26,671,452
Station and Warehouse motor trucks	58	18,469	5	2,339	511	291,445	99	120,876
Trailers	....	....	15	6,198	....	....	199	97,886
Airplanes & seaplanes	2	15,000	1	3,000	56	416,955	43	149,015
Parts of airplanes, except engines and tires	....	5,486	*2,305	1,412	....	148,930	....	72,246
BICYCLES, ETC.								
Bicycles and tricycles	....	75,816	1,066	16,172	....	3,305,498	....	454,644
Motorcycles	864	299,172	1,248	322,215	23,593	7,453,259	7,844	2,121,016
Parts, except tires	....	....	*351,245	158,587	....	....	*1,064,022	560,714
Gas Engines	127	22,687	597	71,231	2,857	560,576	2.590	369,779
Traction engines (steam) except agricultural	....	....	....	....	257	451,293	14	41,741
Automobile engines	1,108	223,311	7,132	773,315	12,429	2,288,174	19,160	2,508,040
Aircraft engines	....	....	8	9,125	....	....	35	21,117
Complete tractors, except agricultural	12	39,399	5	5,314	19,942	19,638,264	149	254,845
Other internal combustion engines	821	260,125	259	47,492	13,400	2,280,504	3,657	491,089
IMPORTS								
Automobiles and parts of automobiles	26	72,538	13	31,219	995	1,146,056	383	638,508
Parts, except tires	....	155.391	....	51,438	....	1,158,058	....	526,389
All other	....	10,318	....	8,459	....	426,754	....	211,604
REIMPORTS								
Automobiles (free of duty)	469	766,053	88	154,259	2,671	4,103,089	2,469	3,796,892

*Pounds

AVALON RUBBER CO. SOLD

AKRON, May 29—By order of Referee in Bankruptcy Harry L. Snyder of Akron, the Avalon Rubber Co. of Barberton today was sold for $28,500 cash to private interests represented by Fred Lahrmer, Akron attorney. The sale is subject to revision, and stockholders have served notice they will file a petition of revision within 10 days. The stockholders bid $30,000 for the plant offering $10,000 cash and the balance on time. The company's liabilities are about $35,000.

50 Per Cent Decline in British Exports

Imports of Cars and Chassis for First Quarter, 1922, Show Increase

WASHINGTON, May 27—Exports of British made motor vehicles and parts during the first three months of 1922 show a decrease of more than 50 per cent as compared to the exports during the same period last year and about 30 per cent as compared to the same period for 1920.

The exports of motor parts show the greatest decline, according to figures sent to the automotive division of the Department of Commerce by the foreign trade commissioner at London. Exports of parts, the figures show, were 33 1/3 per cent of the total for the corresponding quarter of last year and only slightly more than that for the same quarter of 1920.

The figures are as follows:

First Quarter, 1920	No.	Value
Phaetons and cabs	467	£317,991
Commercial vehicles	140	103,028
Chassis	357	257,060
Total	964	678,079
Parts of cars		406,152
Total value		1,084,231

First Quarter, 1921	No.	Value
Phaetons and cabs	840	£638,484
Commercial vehicles	238	213,113
Chassis	427	392,023
Total	1,505	1,243,620
Parts of cars		429,681
Total value		1,673,301

First Quarter, 1922	No.	Value
Phaetons and cabs	376	£255,317
Commercial vehicles	106	108,395
Chassis	287	206,473
Total	769	570,185
Parts of cars		187,102
Total value		757,287

British imports of motor cars and chassis show an increase in the first quarter of 1922, as compared to the same period in 1921, although far below those of the same period in 1920. The net imports for the first quarter of 1922 amounted to 4769 cars and chassis valued at £912,009, as compared to 3443 cars and chassis valued at £798,901 for the same period in 1921, and to 10,152 cars and chassis valued at £3,566,683 for the corresponding period in 1920.

April Figures Down

LONDON, May 16 (*by mail*)—April's Imports of cars and cabs were 1,105 (399), trucks 45 (209), chassis 614 (274) and motorcycle 59 (71). The value of imported parts for vehicles other than motorcycles was £222,695 (£203,440), and of motorcycle parts £5,088 (£12,604) and of tires £426,883 (£163,562). The figures in brackets are for the corresponding month, 1921.

The export of British automobiles in April was: Cars and cabs 142 (179), trucks 192 (267), chassis 45 (102), motorcycles 817 (1160), and the value of parts was: Vehicles, £68,560 (£124,-013), motorcycles, £23,322 (£26,785) and tires £239,652 (£185,997).

The comparative poor showing of British Exports reflects the engineer's trade lock-out.

The Chancellor of the Exchequer has refused to consider the repeal of the import duty on cars. From £5,000,000 the revenue from this duty has fallen to £763,000.

MEMBERS OF M. A. M. A. REPORT SALES IN APRIL TO BE $33,830,000, BIG INCREASE OVER MARCH

NEW YORK, May 29—The following table shows the sales by members of the Motor and Accessory Manufacturers Association, the total of past due accounts and the total of notes held, for all the months of 1921 and first four months of 1922.

Month	Total Sales	Per Cent Change	Total Past Due	Per Cent Change	Total Notes Outstanding	Per Cent Change
1921						
January	$6,264,587	.....	$8,099,727	.....	$4,359,871	.....
February	10,408,962	66.15 Inc.	6,717,165	17.07 Dec.	6,063,118	39.08 Inc.
March	20,120,386	93.30 Inc.	5,603,992	16.57 Dec.	5,069,877	16.38 Dec.
April	26,746,580	32.93 Inc.	5,352,271	4.49 Dec.	5,371,086	5.94 Inc.
May	26,781,350	.13 Inc.	4,505,176	15.64 Dec.	4,460,355	16.77 Dec.
June	22,703,414	15.19 Dec.	4,720,973	4.79 Inc.	4,012,670	10.37 Dec.
July	23,096,214	1.68 Inc.	5,242,046	10.79 Inc.	3,690,154	7.90 Dec.
August	23,397,640	1.31 Inc.	4,348,790	17.06 Dec.	3,494,510	5.30 Dec.
September	23,141,891	1.09 Inc.	4,358,545	.22 Inc.	3,677,500	5.24 Inc.
October	22,053,327	4.70 Dec.	4,512,680	3.54 Inc.	3,463,500	5.82 Dec.
November	18,998,490	13.85 Dec.	4,352,000	3.56 Dec.	3,661,900	5.73 Inc
December	14,349,750	24.47 Dec.	4,220,450	3.02 Dec.	3,384,250	7.58 Dec.
1922						
January	17,320,000	20.61 Inc.	4,450,000	5.45 Inc.	3,146,000	7.02 Dec.
February	22,720,000	31.17 Inc.	4,070,000	8.57 Dec.	3,483,000	10.74 Inc.
March	28,670,000	26.14 Inc.	2,890,000	28.86 Dec.	2,657,000	23.69 Dec.
April	33,830,000	18.07 Inc.	3,000,000	2.00 Inc.	2,500,000	1.5 Dec.

Another Big Month Predicted for June

(*Continued from page* 1182)

The reduction in freight rates will result in important savings for automotive manufacturers on shipments of all materials except completed vehicles. The freight saving on these will be passed on to the consumer. The lower rates will tend to offset recent advances in the cost of supplies.

Virtually all tire factories are running full blast but there are many indications that a price war is imminent. Tires are being made at a much smaller margin of profit and if there is an era of intense price competition the results may be serious for some makers. Reductions averaging from 10 per cent to 15 per cent have been general in the last month. Some of them have been camouflaged but the result is the same so far as the consumer is concerned.

Maxwell to Operate in June at May Rate

DETROIT, May 29—Maxwell Motor Corp. will carry production through June at the high rate which has marked May, present orders already indicating that this will be necessary. President W. R. Wilson said a falling off in business is looked for during July and August, but he is convinced that fall business will be brisk and that sales through the winter will be steady. Important increases are looked for by him in 1923.

The company has been handicapped in its production during April and May through difficulty in getting materials and by labor scarcity, he said. In the Maxwell case this difficulty is with raw material and steel, as it is a company which builds practically every part of its product in its factories at Dayton, Newcastle and Detroit. Coal supply at its several plants is ample, Wilson said, but difficulty in obtaining steel is being attributed to the coal situation.

No action has been taken relative to the refinancing of the Chalmers subsidiary of the company, he said, owing to the failure of the bondholders to reach a decision. The company is being operated pending this action at a rate in keeping with its finances, and is producing between 500 and 750 cars at the present time. The demand for Chalmers cars would warrant a larger production, he declared, but until the financing is determined the schedule cannot be extended.

A. E. A. BOOK READY SOON

CHICAGO, May 31—The standardization handbook which the Standardization Committee of the Automotive Equipment Association is publishing, will be ready for distribution in advance of the convention of the association which meets at Colorado Springs, June 19, according to Charles Hughes, secretary of the committee.

Men of the Industry and What They Are Doing

H. H. Springford Resigns

H. H. Springford, special assistant to President E. G. Wilmer of the Goodyear Tire & Rubber Co. of Akron has resigned to accept the presidency of the Steel & Tube Co. of America at Chicago.

Springford representing New York, Chicago and Cleveland bankers, negotiating the Goodyear company's $85,000,000 refinancing and reorganization program a year ago, was elected treasurer of the company under the new financial control. Last December he was made assistant to the president and took active charge of the company during Wilmer's two months business trip to South America. P. H. Hart was elected to succeed him as treasurer.

Springford, a native of England, received practically all of his business training in Milwaukee in the steel and tube and gas, and the mining business.

No announcement has been made as to his successor at Goodyear.

Bacon Returns to Goodrich

H. M. Bacon, formerly vice-president of the McGraw Rubber Co. of East Liverpool, Ohio, has been named special tire sales representative for the B. F. Goodrich Co. of Akron. Bacon formerly was with Goodrich for a number of years. Two years ago he left the McGraw company and joined the Thomas Cusack Co. in Cleveland. He will assume executive direction of tire sales for Goodrich.

Heads Horseshoe Tire

J. C. Lawrence, Akron, has been elected president and general manager of the Racine Horseshoe Tire Co., Racine, Wis., which is the reorganization of the Racine Auto Tire Co., manufacturing Horseshoe tires, passing through the bankruptcy court. Lawrence was for many years associated with the Firestone Tire & Rubber Co. and was vice-president of the Rotary Club of Akron.

Hoesterman Joins Kickhaefer

Hugo F. Hoesterman has resigned as factory manager of the Stearns Motor Manufacturing Co., Ludington, Mich., to become vice-president of the Kickhaefer Manufacturing Co. of Milwaukee, manufacturer of dies and stampings used in the automotive industry. The Kickhaefer company has been in business since 1907.

McIntyre Leaves Finance Companies

George McIntyre has resigned as vice-president and director of the Metropolitan Finance Corp. and as vice-president and director of the Security Credit Corp., owned by the Metropolitan and previously engaged in the handling of automobile installment paper. McIntyre was one of the founders of the company which was started about four years ago. He was formerly connected with the Continental Guaranty Corp., Commonwealth Finance Corp. and Street & Finney Advertising Agency. McIntyre will announce his new connections at a later date, remaining at this time president and director of the Phoenix Finance Corp. of New York City, and the Ultimate Finance Corp. of Newark.

Durant Names Steigerwalt

A. K. Steigerwalt has been appointed manager of the new parts and service division of the Lansing plant of the Durant Motor Co. Steigerwalt had been connected with the Chevrolet organization since 1909, first serving with the Chevrolet Motor Co. of New York, then at the factory at Flint and recently at the Chevrolet headquarters in the General Motors building, Detroit.

Clayden Chief of Research

A. Ludlow Clayden is now chief engineer of gas engine research for the Sun Co. of Philadelphia. The company is equipping a laboratory at its research building at Norwood, Pa., and Clayden's first undertaking will be a rather elaborate study of factors which affect engine lubrication, with especial regard to piston friction.

Advertising Men to Hear Long

John C. Long, secretary of the educational department of the National Automobile Chamber of Commerce, will speak on "The Trade Association and Better Business" at the educational conference of the international convention of the Associated Advertising Clubs of the World in Milwaukee, June 12.

Carples Is General Manager

James M. Carples has become general manager of the Strut Rod Sales Co., New York City. Carples acted as manager of the automotive department of Flint & Co., Inc., bankers, during the war and in 1919 to 1920 organized the Detroit Motorbus Co.

Levick With Better Tires

J. N. Levick, formerly chief of the layout division of the advertising department of Sears, Roebuck & Co., has joined the Better Tires Co., Chicago, mail order jobbers of tires and accessories, to serve in a similar capacity.

Vansant Made Tire Sales Manager

G. E. Vansant, formerly identified with the Brunswick tire manufacturers, has been added to the executive staff of the F. G. Schenuit Rubber Co., Baltimore, and has been placed in sole control of the sales production department.

Grier and Hill Promoted

J. A. Grier has been made western district manager of the Cadillac Motor Car Co., and has been succeeded as specification manager in the sales department at the factory by Chester B. Hill. Grier began work for Cadillac on April 20, 1916, coming into the sales department. With the exception of the time he was in service during the war he has been connected with specification work and has been in charge of it for the last four years. Hill came to Cadillac in February, 1916, and after eight months in the engineering department changed to the sales. He has been there ever since excepting the thirteen months he served with the Marine Corps during the World War.

Jackson Succeeds Roberts

Ralph B. Jackson has been appointed western sales manager for Rolls-Royce, succeeding J. E. Roberts, resigned. Previous to his present connection Jackson was associated with the Pierce-Arrow Motor Car Co. as district representative for the sales department. During the war he was in the air service, commissioned as a pilot. Jackson will cover the western states from his headquarters located at the Rolls-Royce western branch, 980 Michigan Avenue, Chicago.

Couzens With Investment Company

St. Clair Couzens, formerly associated with the Olympian and Friend motors companies of Pontiac, Mich., is now with the Michigan agency of the Durant Investment Co. as a traveling representative, calling on county headquarters throughout the industrial section of the state.

Amazon Appoints Shea

Announcement is made by the Amazon Rubber Co. that William J. Shea, formerly district sales manager for the Portage Rubber Co., has been appointed head of the company's sales department. He is the first sales manager the Amazon Co. has had since the reorganization last year when the founder of the company, L. J. Schott, assumed direct charge of the business.

Britishers Visit Country

Oliver Stubbs, president of the Institution of British Foundrymen and managing director of Joseph Stubbs, Ltd., iron founders of Manchester, England, and Sir Henry Hollingdrake, managing director of the Hollingdrake Automobile Co. of Stockport and Manchester, have been visiting the principal American manufacturing centers with a view to studying modern American practice in foundry work, machinery design and manufacturing.

Plants Speeding Up in All Branches of the Industry

Big Westinghouse Orders

SPRINGFIELD, MASS., May 31—Westinghouse Electric & Manufacturing Co. has increased its operating force here to 2600, of which number 2000 have been taken on since the first of the year. The automotive equipment and radio departments are running at maximum, and the farm lighting department has shown a marked gain, indicative of the improved farm situation in the Central West.

New fuse box, ignition and cut-out devices are being made ready for production. It is stated that production of starting, lighting and ignition units during May will be triple that of April. Contracts have been closed for 20,000 sets for the Gray car, to be delivered at the rate of 1200 a month; 20,000 for the Gardner car, 15,000 for the Hupmobile, 15,000 for the Velie, and 2500 for the American motor truck. Continental Motors has placed an order with the company for $150,000 worth of Micarta gears.

Many other manufacturers' orders are being received, and a steadily increasing market demand for replacements is reported, so that the prospect for the balance of the year is very promising.

Standard Parts Business Gains

CLEVELAND, May 29—The Standard Welding Co., the rim and tube division of the Standard Parts Co., reports 36 new customers on its books and an expected increase in shipment for May of 100 per cent over March. The increase is not entirely automotive although there is a strengthening demand for the company's exhaust and windshield tubing and rims.

The Eaton Axle Co., axle division of Standard Parts, has received substantial orders from the Cadillac Motor Car Co. Shipments beginning in June are said to be scheduled at a rate greatly in excess of previous orders from this company. Production for C. H. Wills & Co. is also reported to have been materially increased.

The Perfection Spring Co., another division of Standard Parts, reports that its tonnage shipments for May will be the highest of any like period in the last 18 months. Recent releases to truck customers indicate a renewed activity in the commercial car field, while orders from passenger car manufacturers show a very marked increase.

Wilson Foundry Works Sundays

PONTIAC, MICH., May 29—Bending every effort to turn out enough Willys-Knight engines to meet the demand of the Willys-Overland plant in Toledo, which is now calling for 175 engines daily as a June schedule, the Wilson Foundry & Machine Co. here is keeping its plant working on Sundays and holidays.

The output had passed the hundred mark on May 25 after a steady development from the 25 a day which was reached shortly after the line was put in operation in March.

Bock Bearing Approaching Normal

TOLEDO, May 29—The Bock Bearing Co. reports its shipments 80 per cent or better of normal at the present time, and expects June to show practically a normal business. April was the biggest month for this plant since August, 1920. At the present rate, May will be twice as big as April. The roll department is operating overtime. The head grinding department is running a double shift while in certain other departments three shifts are working.

Farm Machinery Shipped

LA PORTE, IND., May 27.—The Advance Rumely Co., shipped 45 carloads of farm machinery from its factory here during the past week. It was the biggest week of the year for the company in farm machinery. The company is operating at about 70 per cent of normal.

Oneida Increasing Schedules

GREEN BAY, WIS., May 29—Excellent progress is being made by the Oneida Motor Truck Co. in booking new business, and plant schedules are steadily being increased to handle orders. Oneida trucks are experiencing a good call east to Pittsburgh and west to the Pacific coast, especially in communities where new building construction is active. Shipments are now being made daily.

Gardner Gain 220 Per Cent

ST. LOUIS, June 1—A statement from the Gardner Motor Co. says that for the five months' period ending to-day there was a gain of 220 per cent in cars shipped over the corresponding months of 1921.

May Best in Moon History

ST. LOUIS, June 1—The Moon Motor Car Co. reports that its sales in May were the largest for any single month in its history. The best previous month was June, 1920, and May exceeded that month by 64 per cent.

Jordan Breaks Record

CLEVELAND, June 1—The Jordan Motor Car Co. states that it broke all production records in May and that the indications are that June will show no slowing up in orders. Most of the demand this year has come from the states north of the Ohio river and east of the Mississippi and from California.

PERSONAL NOTES

Thomas H. Lavier Re-elected

Thomas H. Lavier, inventor of the Lavier formula plates used in Ray batteries, has been re-elected president of the Ray Battery Co., Ypsilanti; M. M. Read, vice-president; J. S. McDowell, secretary, and A. M. Colegrove, treasurer. E. E. Eastburn has been appointed sales manager. He formerly was western district manager of the Republic Rubber Co. with headquarters at Kansas City. Business is reported to be running heavy, and plans have been made for expansion in production. The company has improved its financial position through the addition of the several new officers and is prepared to enter business on a larger scale than formerly.

Young With Willys-Morrow

J. A. Young, formerly of the Sheldon Axle Co., has been appointed general manager in charge of sales of the Willys-Morrow Co. He will have charge of all sales of products which are supplied to other companies outside the Willys interests.

Bradley Leaves Commerce

F. A. Bradley has resigned as secretary and treasurer of the Commerce Motor Car Co. and has gone on a vacation trip to England which will take about six weeks. No announcement of his business plans for the future were outlined by Bradley.

Shaw Goes With Bank

James T. Shaw has resigned as secretary of the Automobile Crankshaft Corp. to become connected with the First National Bank of Detroit. The resignation is effective June 1, but Shaw will continue the secretarial duties for another month though actively connected with the bank.

Fox Appoints Hackethal

P. F. Hackethal has been appointed consulting and research engineer for the Fox Motor Car Co. of Philadelphia. For several years he has been connected with the Mercer and Templar organizations.

AUTOCAR NAME PROTECTED

PHILADELPHIA, June 1—The right of the Autocar Co., Ardmore, Pa., to the exclusive use of the word Autocar in the manufacture and sale of motor vehicles has been upheld by an injunction issued by the United States District Court for the eastern district of Pennsylvania against the Peters Autocar Co. of Bethlehem, Pa., and De Veillier & Co., who offered securities for sale in which they made use of the word Autocar.

Senators Question Need of Graham Bill

Committee Which Reported Reimportation Measure Also Doubts Present Necessity

WASHINGTON, May 26—Passage of the Graham resolution (HJ 183), introduced in the House at the instance of automobile dealers, to prevent the dumping of war trucks and passenger cars into the United States by imposing a 90 per cent re-import tax on all motor vehicles returned from France or any of the allied countries, has been characterized as doubtful.

This is the opinion of Senator McCumber, chairman of the Senate Finance Committee, who has already reported the bill out of committee. Despite the fact that the resolution has already been passed by the House, the opinion has been expressed by Senator McCumber that the measure will not pass the Senate, "for the reason," said Senator McCumber, **"that it is the opinion of the majority of senators that there is not any need for the measure."**

Survey Being Made

At the time the bill was introduced in the House by Congressman Graham, it was the expressed opinion of the automobile dealers that more than 5000 trucks were going to be reimported, thus destroying the present truck market in this country.

In order to determine just that status of the situation, the Department of Commerce has announced that it will make a survey of the trucks and passenger cars in Europe, available for reimport, and the automotive division of the department has already requested the United States trade commissioners in England and France to report as soon as possible.

The Department of Commerce, it is known, is strongly in favor of the Graham resolution, provided there is any real need for it. The only way that this can be determined, the department feels, is to make an actual survey of the number of vehicles subject to reimportation.

Senator McCumber, it is understood, has requested the department to report on the number of trucks that have already been re-imported from Europe during the past three years. Coupled with his request for the figures was the expressed opinion that in the belief of the majority members of Congress the automotive industry was a bit panicky over the situation.

Committee Gets Figures

That this is true, may or may not be borne out by the figures which have been submitted to the Senate finance committee, showing that as near as can be determined there are nearer 1800 trucks in Europe, subject to reimportation, than 5000, the number first stated. It is estimated that there are approximately 1000 trucks in England and 800 in France.

The actual figures on the number of passenger cars and trucks reimported from the two countries are as follows: From France, 1919, four, valued at $10,408; 1920, 35, valued at $168,996; 1921, 536 valued at $979,567; England, 1919, one, valued at $1,460; 1920, 52 valued at $149,645, and 1921, 1,748 valued at $2,668,525.

A report on 500 trucks recently reimported to the United States and shipped to California has been made to the automotive division of the department. The shipment, it is declared, was in very bad condition, and the trucks sold were worth hardly more than their freight from New York.

Aside from any bearing on the number of trucks or passenger cars which are likely to be re-imported, Senator McCumber has declared that there is considerable doubt in the minds of the committee, since reporting the resolution out favorably, that the number of trucks available for reimportation would be sufficient to influence the market. "Furthermore," said Senator McCumber, "these passenger cars and trucks were sold at a good price to the government, nothing was lost on them and the automotive industry having secured the cream of the business then must expect to take a little of the thin now with the thick had during the war."

No action on the bill is at all likely pending the survey which will be made immediately by the department, and whether or not the Senate will act then on the resolution is a matter of speculation, the sentiment now being, among the Senate Committee which has had a chance to study the measure, that the bill is useless legislation and that the time of the Senate can better be devoted to the consideration of more imperative measures.

Slough Trucks Hamper Sales

DETROIT, May 27—General increase in the motor truck field has been handicapped and delayed to a definite extent by the presence in the United States of a still unsold balance of the Slough trucks that were brought back to this country, declare motor truck makers in this district. Though business is now running at about 50 per cent of normal, it is declared an earlier return would have been certain without the Slough competition.

These makers declare that it is not so much because of actual sales made that the Slough influence has been harmful as because of the circularization that was carried out by the Slough group, which made it doubly hard for dealers in new-made American trucks to make sales. The Slough prices created an atmosphere of suspicion toward new truck prices.

This circularization still is being done, resulting in sales only at scattered points, but keeping the entire trade at a disadvantage. Apparently there is little desire on the part of operators to buy the war vehicles, makers declare, but they find it difficult to reconcile the wide divergence between the prices of trucks bought at forced war auctions and trucks made under current competitive conditions.

Overland to Build 785 Daily in July

Willys Says That Company Is Now 18,000 Cars Behind on Orders

TOLEDO, June 1—That the production schedule for the Willys-Overland plant here was gradually increasing and had passed the 500 a day mark on Friday was the statement made to members of the factory management class of Toledo University at their annual banquet at the Toledo Yacht Club on Friday evening by President John N. Willys.

Willys said that the production schedule for July called for 16,500 cars or an average of 785 a day for that month.

"We are 18,000 cars behind our orders now and must speed up considerably during June to make a gain on the sales," he declared.

He said his travels convinced him that next year would better 1922 because of the increased prosperity to come when farmers get in their crops and realize that better conditions are here.

Clifton Reeves, industrial engineer, and W. H. Kilpatrick, manager of manufacturers, of the Willys-Overland Co., were also speakers.

The class which numbers among its members a large percentage of the executives, foremen, and officials of factories in Toledo formed a mythical $25,000,000 automobile concern recently as a study in organization.

May One of Biggest Months in New York

NEW YORK, May 30—May has been one of the biggest sales and delivery months in the history of the automobile business in New York.

Actual comparison figures for the entire trade are not available but virtually in all branches and distributor establishments both wholesale and retail business ran ahead of March and April, which were strong business months, and representatives of several cars report the largest months they ever had.

With the more popular cars, inability to obtain prompt deliveries has held down both sales and deliveries but a good many of these orders have not been lost to the industry, having been turned toward cars of the prospects' second or third choice.

Compilers of registration figures while unable to furnish complete figures anticipate that registration of new passenger cars in ten counties in and around New York will exceed 10,000, as compared with approximately 9200 in April and 7000 in March.

Demand has held strong throughout the spring for closed cars, of which there has been a shortage in several lines.

Indications for June business are decidedly bright.

Murphy Takes Honors in Indianapolis Race

Victory Demonstrates Progress Made During Year by Refinements in Engine

HOW THEY FINISHED

Driver—Car	M.P.H.
Murphy—Murphy	94.48
Hartz—Duesenberg	93.54
Hearne—Ballot	93.04
De Palma—Duesenberg	90.61
Haibe—Duesenberg	90.56
Wonderlich—Duesenberg ..	88.79
Fetterman—Duesenberg ...	87.99
Vail—Duesenberg	85.69
Alley—Monroe	83.89
Thomas—Duesenberg.....	82.19

By J. EDWARD SCHIPPER

INDIANAPOLIS, May 30—Jimmy Murphy with his combination car, the Duesenberg grand prix chassis and Miller engine, which ran under the misleading name of Murphy special, demonstrated by winning the 500 mile speedway race to-day, from a field of 27 starters, what progress has been made in the past year by refining the 183 cubic inch engines.

His average of 94.48 miles per hour as compared with the record of 89.84 set by Ralph DePalma in a Mercedes in 1915, is a good indication of how speed can be increased by cylinder compression of 105 pounds, lighter reciprocating parts, improved lubrication, better engine balance, higher gas velocities and general chassis improvement.

Not only does Murphy's victory indicate progress, but this is accentuated by the fact that all of the first five cars to-day beat the DePalma record of seven years ago which he made in a 274 inch Mercedes.

Murphy Led from Start

Murphy led from start to finish. Hartz, who finished second in a Duesenberg, was never more than two laps behind but never fast enough to overtake Murphy. Murphy stopped three times to change plugs, tires and take on supplies. He carried off all but 45 of the lap prizes, as well as the $20,000 winner's prize. He turned laps at 100 miles per hour and drove as good a race as was ever seen on the speedway.

While the Duesenbergs did not win first place, they had a veritable field day. Seven of the 10 cars to finish in the money were Duesenbergs. To Duesenberg also goes a large share of Murphy's glory as his chassis was the Grand Prix Duesenberg.

It was a bad day for the Frontenacs, not a single one finishing among the first 10. Only one of the five starting, was running at the finish. Three were eliminated with rear axle trouble, one with a broken frame and the other with a broken valve action.

The Ballot entry of two cars had fair success. Hearne won third but his team mate, Goux, was eliminated with a broken axle at 62 miles. Hearne made only one stop, this being for tires and gas at 280 miles. This was one of the most consistent performances during the race.

Of the first 10 all had eight-in-line engines except the four cylinder Monroe which finished ninth. It made two stops for spark plug troubles and three others for fuel, oil and tires. The two

(*Continued on page* 1192)

Parish & Bingham Head Denies Merger Interest

CLEVELAND, May 29—Emphatic denial is made by Agnes D. Morse, president of the Parish & Bingham Corp., that the company of which she is the head has had any interest whatever in plans for a consolidation of the Grant Motor Car Corp., the H. J. Walker Co. and the Standard Equipment Co.

Mrs. Morse asserts that inasmuch as she is the largest individual stockholder of the Parish & Bingham Corp., she would have been consulted if any such plan had been under way. Her company, which is now doing a splendid business and is in a strong financial position, is not interested in mergers of any kind, Mrs. Morse declares, and is perfectly content to stand on its own feet.

Skilled Labor Scarce; Workmen "Shop Around"

NEW YORK, May 31—Difficulty in obtaining an adequate supply of skilled labor has become one of the most pressing problems of the automotive industry and the situation is becoming serious in the larger manufacturing centers, particularly Detroit. The trouble is fully as general in the parts field as in the vehicle branch.

In a good many cases automobile manufacturers are practically bidding against each other for labor. Inasmuch as the workers in automotive plants are not organized, there have been no threats of strikes, but the skilled employees not unnaturally are "shopping around" and taking the jobs which offer the best pay. This is resulting in a steadily mounting percentage of labor turnover.

Present indications are that whatever savings are effected in automotive plants by the reduction in freight rates will be more than offset by higher wage scales if production continues at its present pace.

FORCES INCREASE AT CORK

LONDON, May 16 (*By Mail*)—The number of men employed by Henry Ford & Son, Cork, has increased to about 1700 since the corporation decided to grant the fee-simple of the Marina site to the firm. They are employed at full time, the wages bill amounting to between £8,000 and £10,000 a week.

French Grand Prix Adopts Group Start

Change Is Result of Experience Drivers Gained on American Tracks

PARIS, May 12 (*By Mail*)—American track methods will be adopted in the start of the French Grand Prix road race for 122 cu. in. cars near Strasbourg on July 15. The triangular course being prepared for this race is 8.3 miles around; there will be 22 starters, and 60 laps will have to be covered, giving a total distance of 498 miles.

By an understanding with the drivers, many of whom have had experience at the Indianapolis track, the start will be made in a group, the cars being lined up in line of three according to positions decided by the drawing of lots. This will be the first time that a grouped start has been given in a European automobile road race, and the change has only been made possible by experience gained on American tracks.

Many Without Spare Wheels

Another feature of this race will be that many cars will start without a spare wheel, the drivers being prepared to run a lap on the rim if they burst or puncture just after passing the pits. This again is the result of American experience. In the past this has only been done with straight side tires, which have no tendency to leave the rim when deflated. This year clincher bead tires will be used in the same way.

Michelin has brought out a clincher bead racing type cord tire, which, as shown by tests, will not come off the rim when deflated. Convinced that it will stay on the rim as well as a straight side tire, European drivers are preparing to use the Michelin production because of its lower circumferential weight. Straight side tires were used last year in French and Italian road races, and although they proved to be perfectly safe they were found to set up excessive wear of the steering gear and to make the car hard to hold on an ordinary road.

Another Contest July 16

In addition to the 122 cu. in. race, there will be a speed contest over the same course on July 16 for four passenger cars given a limited amount of gasoline at the rate of 13.7 miles to the American gallon. This is not a stock car race, and while there are no restrictions concerning the engine, minimum body dimensions are indicated and there must be four seats of given dimensions.

Only the driver will be allowed aboard the car, but the equivalent weight of three other persons, at the rate of 154 lb. per passenger, must be carried in the form of ballast. No outside assistance of any kind must be given, nor can supplies of any kind be taken aboard during the race.

Murphy Takes Honors at Indianapolis Race

Victory Demonstrates Progress Made During Year by Refinements in Engine

(*Continued from page* 1191)

Fronty-Fords made a creditable showing, demonstrating their reliability. They made laps at the rate of from 80 to 84 miles per hour until one went out at 400 miles with a broken wheel and the other was running at the finish.

The British Bentley, a four cylinder stock car, gave a most satisfactory performance. This was the only car to go the distance without changing a tire. It averaged approximately 80 miles per hour.

The engineering development responsible for the higher speeds of this year is best illustrated by the fact that this is the first Indianapolis race in which not a single car was eliminated by broken connecting rods. There were no burned out bearings, no burned out valves, no clutch trouble and only one broken steering arm. Detail troubles such as clogged gas lines, leaky water manifolds, broken tank fastenings, loose pans and sticking throttles were still to be found. The fundamental troubles of a bigger nature were more in the axle and chassis parts than in the engines.

Thirty-five tires were changed but many of these changes were made while other troubles were being looked into. Twenty of the tires were right rears, eight were right fronts, six were left rears and only one left front. These changes were not all necessary but many were made on suspicion.

Although Hartz in his Duesenberg made four tire changes, more than anyone else, he still finished in second place. The Frontenacs made several tire changes. Mulford, Sarles and DePaolo each had three stops for tires.

Stops for Spark Plugs

There were 18 stops for spark plugs. The very qualities which made the cars of this year faster than ever before, made the stresses on the spark plugs higher than ever. This was fully shown in the stops at the pits which is not surprising in view of the prevalence of seven to one compression ratios and piston speeds of 26 hundred feet per minute. Magnesium and aluminum alloys of extremely light weight combined with highly efficient lubrication and complete absence of periodic vibration have permitted the high speeds, but the spark plug seems to be the limiting factor, if the records of the race may be interpreted.

The weights of the leading cars were closely grouped around 2000 pounds. The winner weighed 1970, the Hartz Duesenberg 2800, Hearne's Ballot 2600 and DePalma's Duesenberg 2000. The Fronty-Fords were the lightest cars in the race, weighing 1675 pounds.

The pace maintained throughout the 500 miles by the leader was wonderfully consistent. It fell belows 94 miles per hour only around the 200 mark when Murphy changed spark plugs. The average for any 25 mile distance never exceeded 96 miles per hour. The fastest 25 miles was the first at an average of 95.74.

DROPS LOCOMOTIVES

GLOVERSVILLE, N. Y., May 29—Announcement is made by the Fonda, Johnstown & Gloversville Railroad, which connects the New York Central lines with the southern part of the Adirondack region, that on July 1 it will discontinue the use of passenger locomotives on its steam division and substitute gasoline railroad cars for them.

Master Trucks Producing New Low Hung Bus Chassis

CHICAGO, May 29—A new low hung bus chassis is now being produced by Master Trucks, Inc. By underslinging the springs and using frame with pronounced kickup in the rear, the floor height is reduced to 26 in. The model JDB chassis has a 170 in. wheelbase with space for body measuring 192 x 84 in. and arranged to seat 22 passengers. Similar chassis for bodies to seat 26 to 34 passengers are shortly to be offered.

The components used include a Buda 3¾ x 5¼ in. engine, lighting system, Fuller clutch and gearset, Walker double reduction axle, 34 x 4 in. front and 36 x 4 in. dual tires, foot operated propeller shaft brake and bus-type front axle. The chassis is sold with or without body. The latter is of wood construction with plymetal side panels and is completely sealed inside.

Bethlehem Motors Starts with Three Truck Models

ALLENTOWN, PA., May 29—The Bethlehem Motors Corp., which recently was reorganized, will start production on three truck models with others to be added later. The first three will be a 1-ton, 2-ton and 3-ton. Bevel gear drive will be used on the smaller model and internal gear on the two others. The engine of the smaller model will be 3½ x 5 and on the largest models 4 x 5¼.

The prices for chassis are:

1-ton	$1,195
2-ton	1,595
3-ton	2,195

A. A. A. BOLTERS CHOOSE NAME

CHICAGO, May 31—The National Automobile Association is the name chosen by the former members of the American Automobile Association who bolted from the St. Louis convention, for the new organization of motorists which will be formed. The organization will be perfected at a national conference to be held at the Hotel Sherman June 19.

All Industry Active Through Northwest

Building Advances, Trade Thrives and Farmers Plant Diversified Crops

MINNEAPOLIS, May 29—Reports from the Ninth District Federal Reserve Bank in Minneapolis, from banks generally, labor employment bureaus, etc., are optimistic as bearing on business generally. Even in building this district leads the country for the quarter, showing a gain of 150 per cent as against an average of 83 per cent.

At the St. Paul Federal Land Bank applications for loans in April exceeded any previous month, approximating $5,000,000. Since the opening of the bank five years ago, the loans have reached 18,411, totaling $61,000,000. In fact, the assets have reached $69,000,000 against $3,315,535 capital stock. President E. Q. Quamme said, on the birthday of the bank, May 1, that conditions in the Northwest are greatly improved.

Eastern investors are finding farm mortgage loans in this territory attractive and rates have been reduced materially, approximating the 6 per cent rate of the Federal bank in many instances. Wheat acreage, he said, will be somewhat less this year in this section because planting was delayed by the late spring. He forecast good prices for farm products and a total acreage close to an average normal.

The Federal District report is to the effect that the agricultural outlook is good with winter sown crops better than the average throughout the country, and the knowledge that crops have been so much more diversified that even a poor crop year would not have the serious effects that it would have had heretofore. Western North Dakota and Montana are fortifying themselves by the introduction of the dairy cow, which is a further protection against the loss of any one crop through weather conditions.

March Sales Doubled

In the district business has increased month to month, until the volume is above that of a year ago. Implement sales were doubled in March over February preceding. Continued advances of prices in agricultural sections of farmers' products and the turn of the season into spring, has renewed among all classes a feeling of optimism, and it is assured the farmer is not down and out. Distribution of new trucks and agricultural machinery generally is another factor for rejoicing as indicating the farmer, the backbone of the district, has some money after all.

In the Twin Cities the unemployment situation is fading into conditions that indicate that for labor generally there are more jobs than applicants for work. In Minneapolis conditions generally are improving. Increased demand for farm labor and for workers in building is absorbing the bread line frequenters.

73 Makes Displayed At Barcelona Show

Both Former Enemy Nations and Allies Exhibit—Trade Revival Expected

BARCELONA, SPAIN, May 29 (*By Cable*)—This city is now holding the first international automobile exposition since the armistice in which the cars and trucks of both the allied and the ex-enemy countries are being shown in the same hall. The Barcelona show, undertaken with the expectation that it would revive trade after the depression of last year, is being held in a large modern art palace at Montjuich, in the suburbs of the city.

The show has brought together 73 makes of passenger cars and trucks, representing America, France, Italy, Belgium, England, Spain, Germany and Austria. The largest representation, as might have been expected and consistent with the world-wide development of automobile sales, is that from America, with 24 makes. A floor space of 150,000 sq. ft. is being used. This does not make it the largest exposition in Europe, but it is the most international, bringing together, as it does, the lines from all the automotive producing companies. The ex-enemy exhibits are side by side with those from the Allied countries.

Exposition Well Supported

Both manufacturers and local dealers and distributors are supporting the exposition, and these representatives are decidedly hopeful that it will furnish the impetus needed to get sales under way again in a much improved volume. The Spanish trade was decidedly hard hit last year, not only by the financial depression and the decline of the peseta, but as well by a stiff tariff that practically precluded any major importations.

The tariff regulations happily have been changed, although it cannot be said that dealers are overly pleased with the new provisions. The peseta has climbed materially from the low point of last year. Further improvement is to be hoped for, and if this comes about there should be a further betterment of the trade. In fact, quite an improvement already has taken place, and Spanish business is generally along much higher lines than it was only a few months ago.

America Holds Market

France formerly held the premier position in the Spanish market, but this has been lost to America, which now holds the leadership here by a long margin. The French makers are further hit by the fact that Spain and France are waging a private tariff war between themselves. Owing to it the French are practically unable to do business here. However, a commercial treaty is being prepared which will put France on the same footing with other nations, and it was expected that it would have been signed before the opening of the show. Owing to the failure to promulgate it, only 17 French makers have sent exhibits. These firms admit that they are doing business here now.

The Spanish automotive trade is further unsettled by the fear that automobile taxes may be raised considerably. Dealers, distributors and others in the trade are vigorously fighting the tax project, but the immediate effect is to hold up business.

Dealers representing the important American lines are optimistic over prospects for future sales and believe that the drawbacks will be overcome. They state that the present year has opened auspiciously and are hopeful that Spain stands on the threshold of an important automotive development.

W. F. BRADLEY.

American Made Cars Sold Best at Amsterdam Show

AMSTERDAM, The Netherlands, May 17 (by mail)—One hundred and fifty cars, representing 42 different makes, were exhibited at the annual exhibition of motor vehicles which has just closed here. Of the makes, 16 were American made cars, 12 French, 11 German, 2 Great Britain and 1 The Netherlands.

The medium and small types of car were the most popular, as prices are almost double those in effect in the United States. Dealers in the low-priced cars state that sales were above expectations, and it is estimated that 75 per cent of the cars sold during the show were of American make. Few American accessories were displayed.

Rupert B. Bramwell Dies Following Brief Illness

NEW BRUNSWICK, N. J., May 29—Rupert B. Bramwell, for the last 14 years advertising manager of the Michelin Tire Co., died of pneumonia at his home here last week after a brief illness. He was widely known in the automotive industry.

Bramwell was born in Terre Haute, Ind., in 1876, and entered the automotive industry in 1900 when he joined the DeDion Bouton Motorette Co. which sold the French DeDion car. While with this company Bramwell made the first long distance run on record, motoring from New York to Boston, which was considered a remarkable achievement.

Later he became advertising manager of the Pope Toledo car after which he devoted himself entirely to advertising. He was connected with the Cosmopolitan, the Scientific American and Leslies and was with the Class Journal organization for about four years.

Bramwell joined the Michelin Tire Co. in 1909 and played a prominent part in building up that organization. He not only directed the advertising of the company but spent some of his time calling on distributors in important centers and putting through big sales contracts.

Bramwell is survived by his widow and one son.

Pamphlet on Roads For High Schools

Booklet Prepared for Universities So Successful Use Will Be Extended

WASHINGTON, May 31—Prompted by the success of the educational outline on highway transport prepared for university use under their direction by Prof. Lewis McIntyre, the officials of the Highway and Highway Transport Education Committee have now turned to Professor Buckner of the School of Education of the University of Pittsburgh to translate the book into language designed for use by high school students.

The new pamphlet will be prepared in co-operation with officials of the U. S. Bureau of Public Roads, the United States Bureau of Education and other organizations represented on the committee, and will be the first comprehensive effort to place the subject of highway transport before the high school students of the country.

Officials of the educational committee plan a thorough revision of the text in the fall, at which time much new information, which is constantly being made available from the studies of the Bureau of Public Roads and other agencies, will be added.

Mrs. Florence Fox, specialist of educational systems in the Bureau of Education, has been working for several months in the preparation of an outline on highway transport for use by students in the fifth and sixth grades. This work has taken the form of project teaching, by means of which the pupil examines the relation of highway location, construction and use to the historical, civic, geographical and economic development of the community in which he lives.

Star Models to Be Shown at Exhibit in New York

NEW YORK, May 31—No official announcement has been made thus far of the merchandising plans for the Star car, designed to compete with Ford, which will be built by Durant Motors, Inc., under contract for the Star Motor Car Co., itself a subsidiary of Consolidated Motors.

Progress is being made in the development of models for display purposes and a show will be staged in New York within the next month. Various models, including the stripped chassis, the phaeton, coupe and sedan, together with the "station wagon," will be shown. Special passenger and commercial body models also may be brought out.

The personnel of the Star organization has not been completed, and no distributors have been appointed officially thus far. It is understood only distributors will be named, and that they will be given liberal territory with the right to appoint as many dealers as they see fit.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

In general call money was decidedly easy last week, loaning the greater part of the time as low as 3½ per cent. The advance on the afternoon of May 26 from 3½ to 5 per cent was attributed largely to the close approach of the June 1 interest and dividend disbursements. The range for the week was 3½ per cent to 5 per cent as compared with 3 per cent to 3¾ per cent in the previous week. For fixed date maturities little change was noted; in general, business was quiet and no large transactions in any maturities were recorded. The range for the week was 4 per cent for sixty days and 4 per cent to 4¼ per cent for maturities of from ninety days to six months, as compared with 4 per cent to 4¼ per cent for all maturities in the previous week. The prime commercial rate continued to be 4¼ per cent.

On May 25 Secretary Mellon announced an offering of $200,000,000 of Treasury Certificates of Indebtedness with interest at 3½ per cent. These Certificates will bear interest from June 1 and will be payable Dec. 15, 1922.

The Federal Reserve statement as of Feb. 24, 1922 showed the following increases: $4,128,000 in total reserves, $2,546,000 in gold reserves, $26,785,000 in total bills on hand, $28,021,000 in total earning assets and $31,131,000 in deposits. Federal Reserve notes in circulation registered a decline of $18,426,000. As a result of the foregoing changes the reserve ratio declined from 77.6 per cent to 77.5 per cent.

The New York Institution showed a decrease of $1,333,000 in gold reserves and of $1,779,000 in total reserves. Total bills on hand increased $25,907,000 and total earning assets $23,379,000. Total deposits showed an increase of $16,880,000, while Federal Reserve notes in circulation declined $2,517,000. The reserve ratio declined from 86.2 per cent to 85.2 per cent.

Weekly bank clearings at the leading cities of the United States for the week ending May 25 aggregated $6,886,225,000, a loss of 1.6 per cent from last week, but a gain of 21.7 per cent over the corresponding week of last year. Outside of New York the total was $2,539,825, a decrease of 4.5 per cent from last week, but an increase of 14.4 per cent over the corresponding week of 1921.

W. A. PHARES SENTENCED

BLOOMINGTON, ILL., May 31—W. A. Phares, former treasurer of the Pan-American Motors Corp., Decatur, Ill., pleaded guilty to the embezzlement of funds of that company and has been sentenced to the penitentiary for a term of years of not less than one and not more than fourteen.

G. M. C. EXPANDS AT DAYTON

DAYTON, OHIO, May 29—The General Motors Corp. has transferred several activities to the former Dayton-Wright airplane factory and the building now is fully occupied. Included in the work now being done in this plant is the making of parts for old type machines and service work for the Delco lights. The General Motors Corp. has leased the west side plant of the Dayton Products Co. in which it is making steering gears.

FINANCIAL NOTES

Kissel Motor Car Co. has sold an issue of $750,000 of its first mortgage 7½ per cent sinking fund 15-year gold bonds to A. C. Allyn & Co. of Chicago. The bonds are offered for subscription at par and interest. They are dated April 1, 1922, and secured by a closed first mortgage on all fixed assets of the company.

Maxwell Motor Corp. net profits for May are expected to run close to the $600,000 mark. The company now has a working capital of approximately $16,500,000, of which $5,000,000 is cash and securities. Current liabilities aggregate about $2,600,000. In the first quarter of the year earnings were around $30,000.

Republic Rubber Corp. has completed arrangements with banks for issuing $1,500,000 certificates of indebtedness. Proceeds will be used to retire $1,000,000 certificates issued in January and provide additional working capital to meet requirements of expanding sales.

Reynolds Spring Co. balance sheet as of April 30 shows cash, $107,787; accounts receivable, $132,199; notes receivable, $20,474; discounted notes receivable, $40,000; notes payable, $79,000; accounts payable, $126,536; and surplus, $183,708.

Rolls-Royce of America, Inc., reports net loss for 1921 of $796,402. The balance sheet as of Dec. 31, shows total current assets of $1,629,573 and total current liabilities of $284,878, leaving a net working capital of $1,344,095.

Lage Bros. & Co. announces that books have been closed on the offering of 60,000 shares of no par common stock of **Moon Motor Car Co.**, the issue having been oversubscribed.

MERGER TALK ENDS

CLEVELAND, May 29—Talk of a merger of the Grant Motor Car Corp., the H. J. Walker Co. and the Standard Equipment Co. has ceased, and the deal has been declared off by reason of the cancellation of an order for motors that has been given the Walker company by a large manufacturer of motor cars. A syndicate of local men had put forward the merger for the purpose of uniting factory units whose products would turn out a complete automobile.

NEW DATE FOR ALLEN SALE

COLUMBUS, May 29—Failing to sell on a previous date the assets, including the plant and good will of the Allen Motor Co., the receivers, W. C. Willard and George A. Archer, have secured another order from the United States District Court for the sale of the property at public auction June 27 at 9 a. m. at the Columbus plant on Dublin Avenue.

Asks Freight Data for Airplane Line

Government Wants to Know Volume Available in New York-Chicago Service

WASHINGTON, May 29—The War Department has begun the compilation of information as to the probable volume of freight traffic available for the support of a commercial airplane line between New York and Chicago. The Government desires to promote the commercial use of airplanes so that the development of aeronautics in this country may keep pace with the advance in other nations. In a letter to the heads of commercial organizations, asking them to collect the data required, Major General Patrick, chief of the air service says:

This office has under investigation the possibilities of civil aircraft operating as a transportation agent along organized routes. In particular, an organization to promote daily overnight transportation between the industrial communities of New York and Chicago is being considered.

It is of first importance to determine as accurately as possible what the average daily volume of traffic would be which would utilize overnight air transportation if it were so established that the reliability and safety of service were comparable to present-day railroad standard. Merchandise and express will probably be collected in the downtown districts of New York and Chicago between 6 and 7 p. m., with delivery the following morning in the opposite city between 7 and 8 o'clock. It will be necessary to charge probably between $1 and $2 a pound at least during the development period.

Emil Schwarzkopf, Unique Figure in Industry, Dead

NEW YORK, May 31—Emil Schwarzkopf, a widely known and unique figure in the automotive industry, died last week in Roosevelt Hospital after an illness of several months resulting from a general break-down. He was 70 years old.

Born in Austria, Schwarzkopf came to the United States in the 80's and not long after his arrival started a little automobile magazine. He later established Automobile Topics which he conducted for several years but finally sold. At one time he developed a four-cylinder motor car.

Schwarzkopf was a thorough student of the industry and voiced his opinions frankly. He had many friends, but his very bluntness made numerous enemies for him. He had written much about the industry and in 1909 published The Motor Cyclopedia. After he retired from the publishing field Schwarzkopf went into the accessory business in Detroit as a manufacturer's agent.

After his break-down in this city several months ago, Schwarzkopf was cared for by his friends in the industry and sent to the hospital, where determined efforts were made to restore his health.

Automotive Industry Big Reviving Factor

Federal Reserve Board Notes Part Played in General Stabilization

WASHINGTON, June 1—Increased production of automobiles during March and April has revived the demand for iron, steel and copper products and assisted in stabilizing other industries, according to a report issued by the Federal Reserve Board to-day in reviewing general business and financial conditions throughout the Federal Reserve districts during the month of May.

In the opinion of the board, the indicated yield of the principal agricultural products has been an outstanding feature in the developments of the past month. Quite significantly, the board says: "Business, in so far as dependent upon current agricultural prospects, shows steady improvement, notwithstanding diminished export shipments of agricultural products, particularly grains, as disclosed by the ten months' figures since the beginning of the fiscal year, and notwithstanding further a slackening of the demand for agricultural products for domestic use."

It is believed that the adjustment of prices among commodities and industries is approaching a more normal relationship. The heavy purchases of automobile manufacturers and railroads is one of the bright spots of the steel industry.

Discussing automobiles, the Board says in part: Exports have shown a considerable increase. A few popular medium and low priced makes have been selling in larger quantities than ever before, while many dealers are several weeks behind in their deliveries. Used cars are being accepted on a more equitable basis than heretofore, when concessions were made in order to stimulate business, and a larger percentage of sales now involves no trades.

The Department of Commerce in its review for April declares that one of the striking features of the month of April was the increase of some 30 per cent in the production of automobiles. It is declared that April was a month of assimilation and of the adjustments of conditions for progress in later months. It is very encouraging, the department says, that business for the most part is advancing in this less spectacular but more substantial manner.

CLOSED CARS MORE POPULAR

CLEVELAND, May 29—Another indication of the increasing popularity of closed cars is found in the report of the Peerless Motor Car Co. that it is several weeks behind in filling orders for its new 5-passenger sedan. There also has been a large increase in orders for the other closed models manufactured by the company.

FRANKLIN AWARDS PRIZES

SYRACUSE, May 29.—The Franklin Automobile Co. has distributed $4,000 in cash prizes to 226 employees in connection with its second "suggestion contest." The prizes were given in recognition of efforts made by Franklin men in the past six months to improve the quality of the Franklin car and cut down the cost of production without impairing quality. There were three prizes of $400 each, one of $300, three of $200, two of $100 and five of $50 in addition to a large number of smaller awards.

INDUSTRIAL NOTES

Western Vulcanizer Manufacturing Co. has removed its factory to Plymouth, Ind., which will give enlarged manufacturing facilities for its specialties. It will also enable the company to introduce a new item of vulcanizing equipment. The general and sales offices remain at 150 North Desplaines Street, Chicago, where H. K. Wheelock will continue to make his headquarters. The factory superintendent, I. W. Clark, will be in charge of the factory at Plymouth.

Rowe Motor Manufacturing Co. announces that it has decided to erect a new factory building 327 feet x 120 feet at Lancaster, Pa., which will be devoted to the production of the Anderson truck tire. The Rowe company recently took over the Hydraulic Devices Corp. and the Anderson Tire Manufacturing Co. Senator Owen of Oklahomo was one of the large stockholders in the tire company which has a factory in Washington, D. C.

Hercules Steel Casting Co. of Milwaukee has been successful in its defense to a suit brought by a stockholder for the appointment of a receiver and the issue of restraining injunctions. In dismissing the litigation, the Milwaukee Circuit court assessed costs of the action against the stockholder, Chris Thomsen. The defense was made by E. G. Gennrich, secretary-treasurer and manager of the company.

Zee Zee Rubber Co. plant at Yardville, N. J., has been sold at trustee's sale for $58,000 to a group of New York men represented by E. D. Newman, 29 Broadway, New York City. It is said that the group plans to organize a company to make automobile tires and tubes.

Earl Motors, Inc., has discontinued the use of the former Bohnet plant at Lansing, Mich., which was used for partial body production when the company was the Briscoe Motor Corp.

Receivers Postpone Sale of Auto-Lite to June 7

TOLEDO, May 29—No one appeared to bid for the Electric Auto-Lite division of the Willys Corp. at the sale scheduled at the County Court House to-day and the sale was postponed until June 7 by Receivers Frank P. Kennison and Francis G. Caffey, who were given power to postpone in the original order of the court.

Clement O. Miniger who is expected to acquire the property has resigned as a receiver for the Willys Corp. in anticipation of the sale. He was not ready to present his bid to-day but will do so next week, according to his attorney. The Fostoria Toledo plants are included in the offering at an upset price of $4,700,000.

METAL MARKETS

Automotive consumers continue to set the pace for steel buyers in other industries. Their leadership among buyers is all the more impressive as steel statisticians only a few days ago made their annually recurring discovery that the tonnage consumption of "the automobile industry" is relatively light. One of these statistical commentators said: "One cannot get far away from a factor of 5 per cent for the motor vehicle industry, despite its very large consumption of pickled sheets, blue annealed sheets, cold-finished steel bars, etc." In the first place this estimate of a 5 per cent consumption of the entire steel production by the automotive industries is utterly fallacious because it is computed on the basis of the weight of the finished vehicles, taking no account, whatsoever, of the steel that is used in the automotive industries and does not appear in the weight of the finished cars.

Take for instance the highest priced steel of which a pound sells for approximately 50 times the price of tonnage steel, i.e. high speed steel. This market had been dormant for months. Within the last few days it has undergone a revival as the result of automotive demand and 18 per cent tungsten steel now quoted at 75 @ 80¢ a lb. is destined for an early advance as the result of this demand. As an index to the important part which the automotive industries play in the steel market the only fair method of statistical presentation would be one showing in dollars and cents the amount of steel orders emanating from the automotive industries.

Pressure on the pickling capacity of sheet rolling mills, as the result of automotive demand, is such that they constitute the only division of the steel industry in which the daily output falls considerably short of the demand. And it is freely admitted by the tonnage critics that the automotive industries consume virtually all pickled sheets produced. Inability of the pickling departments to cope with the demand and insufficiency of the supply of sheet bars over the next month or two are the factors chiefly responsible for the worried look of automotive purchasing agents who are bending their every effort to insure a steady flow of material to their plants. The price situation is clarifying and greater stability is in sight.

Pig Iron.—Some Middle West automotive foundries needing early deliveries of foundry iron have been compelled to pay as high as $24, others enjoy protection at more favorable figures.

Steel.—Makers of cold-finished steel bars having automotive orders find difficulty in securing a sufficient supply of hot-rolled bars. There is much talk of the inadequacy of the prevailing spread between hot-rolled and cold-rolled bars and an advance in prices for the latter is not improbable. For strip steel some automotive consumers are reported to have offered premiums of $5 per ton for prompt shipment. In the Pittsburgh district automotive consumers appear to have the sheet market more to themselves as most of the other sheet consuming industries have temporarily withdrawn. Bolts and nuts are being contracted for freely by automotive consumers in spite of the recent advances.

Aluminum.—Some odd lots of imported ingots continue to be offered at concessions but on the whole the market is steady.

Copper.—Amid improving export demand copper prices have scored fractional advances.

Calendar

SHOWS

Nov. 13-18 — Chicago, Annual Show and Meeting of the Automotive Equipment Association.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

July 1-24—London (Olympia), Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile Exhibits in Connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague, Automobile Show.

Sept. 25-Oct. 3—Berlin, Automobile Show at the Kaiserdamm Hall under the auspices of the German Automobile Manufacturers Association.

September — Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 4-15 — Paris, Automobile Show, Grand Palais.

Nov. 3-11 — London (Olympia), Automobile Show.

Nov. 10 - Dec. 19 — Brussels, Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show, British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

RACES

July 15 — Strasbourg, French Grand Prix.

CONVENTIONS

June 11-15—Milwaukee Annual International Convention of the Associated Advertising Clubs of the World.

June 19-20 — Detroit, Summer Convention of the Automobile Body Builders Association.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28-Sept. 2 — Detroit National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

June 20-24 — White Sulphur Springs, W. Va., 1922 Summer Meeting of Society of Automotive Engineers.

Canadian Tax Law Will Boost Prices

Automobiles on Hand May 23 Subject to 5 to 10 Per Cent Levy

OTTAWA, ONT., May 26—Automobiles in the hands of agencies at midnight on May 23, on which bona fide sales had not been made, will be subject to the new tax of 5 or 10 per cent, according to the value, and also subject to the increase of 50 per cent in the sales tax, it was learned by inquiry at the Department of Finance yesterday.

The matter of administering the new taxes will be in the hands of the Department of Customs and Excise, the officers of which department will receive, it is expected, many requests for adjustments where sales had been partially completed before the new taxes became effective.

The budget provisions respecting automobiles read: "Schedule 1:—Automobile adapted or adaptable for passenger use, valued at not more than $1,200 each—5 per cent.

"Automobile adapted or adaptable for passenger use, valued at more than $1,200 each—10 per cent."

Canadian Made Cars Included

This tax applies on automobiles manufactured in Canada, as well as upon those imported into Canada after midnight of May 23.

George J. Pink of Pink & Blackburn stated in connection with the increased tax on motor cars:

This means that the price of all cars in Canada selling under $1,200 will increase about 6½ per cent and all cars selling over that price by about 11½ per cent. The increase will naturally go into effect at once.

It is the impression that the changes will give a shade of advantage to the sellers of Canadian made cars. The increase on Canadian made cars will be on the actual price to the dealer, while the increase in the American made cars will be their price to the dealer plus the duty.

Pink said that the increase will be passed along in every case to the buyer. In addition to the increase in cars specifically there is the increase in the sales tax. The present sales tax on cars was 3 per cent and the 50 per cent increase in the tax would mean that the sales tax in future would be 4½ per cent.

The chief selling American cars in Ottawa are the Hudson, Marmon, Maxwell, Chalmers, Nash, Moon, Studebaker, Cadillac, Packard and Dodge Brothers.

J. G. McGuire, of the J. G. McGuire Co., Ltd., stated that so far as the increase in the sales tax was concerned, his firm, which handles the Chevrolet, which is a Canadian made car, would absorb the increase. It was probable, however, that any increase in the internal taxes on Canadian made cars would be passed on in some degree at least to the purchaser.

Dodge Begins Shipping Its New Closed Models

NEW YORK, June 1—Dodge Brothers have begun shipments to dealers of their new closed models. Production of the old models was practically suspended several weeks ago and dealers have on hand a large number of orders for the closed cars.

The new sedan does not show a complete stream line design, but the radiator and hood are 3½ in. higher than in the old model, although a slight dip from the dash remains.

The rear axle is a new assembly, heavier than the old, of ¾ floating design instead of full floating.

Many minor changes have been made in the sedan body.

The new sedan is now on display at numerous showrooms and shipments of the phaeton will be made in the near future.

MUCH TIRE FABRIC USED

NEW YORK, May 29—Approximately 180,000,000 lb. of tire fabric are needed to meet the annual requirements of the automotive industry in this country, according to an estimate made by the American Wool and Cotton Reporter. This is at the rate of between 300,000 and 400,000 bales of cotton a year without any consideration of waste in manufacture. When this factor is figured the total used approximates 500,000 bales.

Colombia Opens Oil Fields; Prices Fall

Automotive Interests See Greater Opportunity for Sales Because of It

BARRANQUILLA, COLOMBIA, May 5 (*By Mail*)—An immediate result of the opening up of the Colombian oil fields is the radical reduction in fuel prices just announced by the Tropical Oil Co., which controls the Perdices field at Barranca Mermejes in the Department of Santander. Gasoline has been reduced in price from about $7 (Colombian gold) to $4.20 in ten-gallon lots and kerosene to $2.75 for the same amount.

Automotive representatives here look forward to larger sales as a result of this price change, as the cost of fuel has always been one of the drawbacks to extensive development. Raul H. Mendez y Cia., distributor for Ford and some of the General Motors lines, as well as tires and accessories, declares that the reductions will give a great impetus to the trade and predicts larger business during the coming months.

The exploitation of the Colombian oil fields is proceeding rapidly. Roads are being cut through the jungles to provide transportation and the activities are growing daily. Concessions in the fields stipulate that fuel must be sold in this country at prices comparable to those at New York, and gasoline and kerosene will fluctuate here in sympathy with New York.

At the present exchange rate, the gasoline prices here would be about $3.78 (U. S. gold) in the ten-gallon tins.

COMPLAIN OF TIRE COMPANY

WASHINGTON, May 29—Formal complaint against the Keaton Tire & Rubber Co. of San Francisco has been made by the Federal Trade Commission, in which it is charged that this company disparaged a competitor's name and goods. The company has been given 30 days in which to reply, after which the case will proceed on its merits.